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ABSTRACT

This training outline for rotary drill operators, one in a series of eight outlines, is designed primarily for company training foremen or supervisors and for trainers to use as an industry-wide guideline for heavy equipment operator training in open pit mining in British Columbia. Intended as a guide for preparation of lesson plans both for classroom and on-the-job training activities, this outline is divided into eight modules. Each module is based on 2 to 19 objectives. For each objective, key points and procedures are outlined. Module topics are basic safety and operating rules, communications, indicators and controls, pre-start and operational checks, basic operation, service the drill, move the drill, and special assignments. A skill profile chart is attached. (YLB)

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OPEN PIT MINING JOB TRAINING SERIES

ROTARY DRILL OPERATOR

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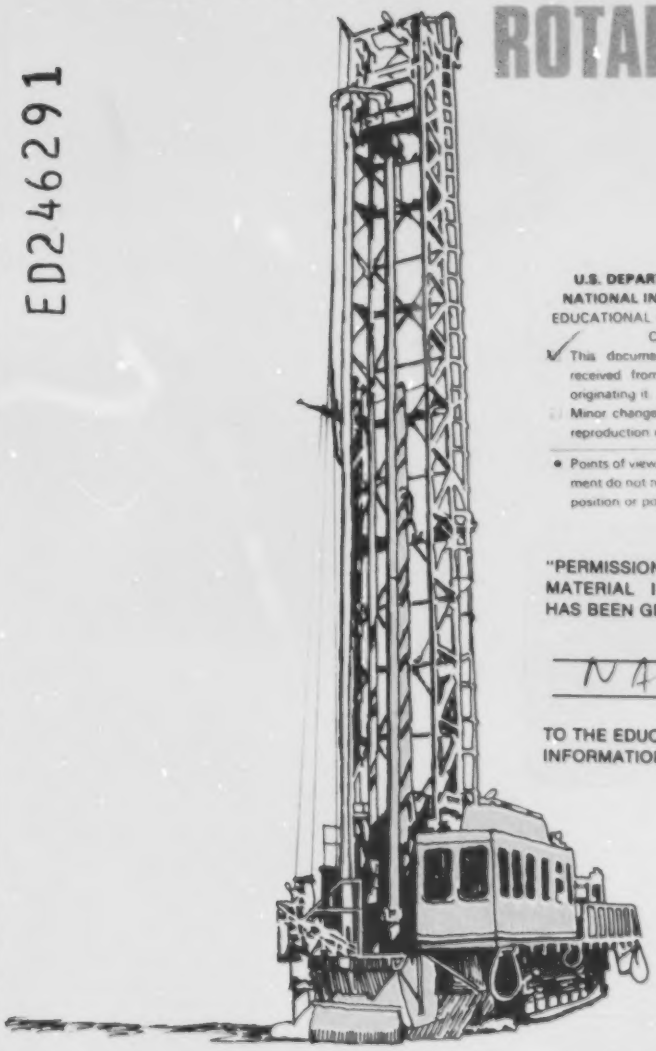

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Titles in the Open Pit Mining Job Training Series

- Haulage Truck Operator
- Rubber Tire Dozer Operator
- Track Dozer Operator
- Front End Loader Operator
- Grader Operator
- Rotary Drill Operator
- Shovel Operator
- Heavy Duty Tireman

OPEN PIT MINING
JOB TRAINING SERIES
ROTARY DRILL OPERATOR

A joint project
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and
member companies of the
Mining Association of British Columbia

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INTRODUCTION

The *Open Pit Mining Job Training Series* was developed through the co-operation of member companies of the Mining Association of British Columbia and the Post-Secondary Department of the Ministry of Education. The series was initiated by the education and training committee of the Mining Association. The committee chairman, Les Redford, has given invaluable support throughout the project.

The training outlines in the series are primarily written for company training foremen or supervisors and for trainers to serve as an industry-wide guideline for heavy equipment operator training in open pit mining in British Columbia.

THE DEVELOPMENT PROCESS

DACUM

Each of the training outlines in the series was developed using the DACUM process, a systematic model for developing modular training programs. A series of four booklets describing the DACUM process is available from:

Publication Services Branch,
Ministry of Education,
878 Viewfield Road,
Esquimalt, B.C.
V9A 4V1
Telephone: (604) 387-5331

Project Initiation

The Mining Association's education and training committee gave early direction to the project. Committee members actively working with chairman Les Redford were:

Bill Scribner, Brenda Mines Limited

Bill Dement, Craigmont Mines Limited

Tom Nicholson, Mining Association of British Columbia

Glen Martin, Similkameen Division, Newmont Mines Limited

Vic Dawson of the Ministry of Energy, Mines and Petroleum Resources also participated with the committee in setting directions.

The first workshop with representatives from the mining industry, the Mining Association, and the Ministry of Education was held in April, 1979. Project goals and priorities were set and an activity plan was established.

DACUM Workshop and Skill Profile Charts

A three day DACUM workshop was held in June 1979. This workshop was conducted by Diane Morrison, a program developer from the Ministry of Education. The following representatives participated in the workshop:

Fred Mason, Afton Mines Limited

Ivan Moser, Afton Mines Limited

Bill Savilow, B.C. Coal Ltd.

Vern Bouck, Bethlehem Copper Corporation

Ray Chenier, Bethlehem Copper Corporation

Bill Scribner, Brenda Mines Limited

Ron Owens, Cyprus Anvil Mining Corporation

Dennis LeDuc, Endako Mines Division, Placer Development Limited

Terry Perrier, Fording Coal Limited

Barry Tripp, Granisle Mine, Noranda Mines Limited

Tom Nicholson, Mining Association of British Columbia

Fred Savage, Ministry of Education

Jack Murray, Noranda Mines Limited

Ed Rudolph, Noranda Mines Limited

Don Rankin, Similkameen Division, Newmont Mines Limited

Don Barker, Zapata Granby Limited

The DACUM workshop produced heavy equipment operator skill profile charts. Each chart listed the essential skills needed by the operator on the job. During the following months, the skill profile charts were circulated to representatives throughout the mining industry for validation.

Training Outlines

Once the skill profile charts were approved, the next step was to write training outlines. For each skill on the charts, one or more objectives were written that state what the trainee must be able to perform at the end of the training program to demonstrate mastering the skill. A trainee who can do all the objectives in the outlines is considered to have the skills required to perform on the job. A training outline developed using this approach is often referred to as a performance or competency-based outline.

Bill Savilow from B.C. Coal Ltd. (formerly Kaiser Resources) was selected to write six training outlines from the skill profile charts. He worked part-time on the outlines while continuing his responsibilites in the training department at B.C. Coal. Bill wrote the *Haulage Truck Operator, Rubber Tire Dozer Operator, Track Dozer Operator, Front-End Loader Operator, Grader Operator* and *Rotary Drill Operator* outlines during 1980 and 1981.

Don McColman of Newmont Mines wrote *Heavy Duty Tireman,* and Larry Hartley of Utah Mines wrote *Shovel Operator.*

Bruce Kurschenska of B.C. Coal Ltd. supplied the photographs upon which the cover illustrations are based.

Reviewing the Training Outlines

Throughout 1980 and 1981 a series of workshops were held to review the outlines. The workshops were conducted by Diane Morrison and attended by participants from various mining companies. The participants who played an extremely important role in examining and revising the training outlines to reflect training standards required across the industry were:

Hans Geertsema, Afton Mines Limited

Fred Mason, Afton Mines Limited

Bill Savilow, B.C. Coal Ltd.

Vern Bouck, Bethlehem Copper Corporation

Jerry LeBlanc, Bethlehem Copper Corporation

Don Miller, Brenda Mines Limited

Gerry Cooper, Brinco Mining Limited

Richard Schwengler, Equity Silver Mines Limited

Don Fraser, Cyprus Anvil Mining Corporation

Terry Wozniak, Fording Coal Limited

Norm Myhre, Gibraltar Mines Limited

George Sutherland, Highmont Operating Corporation

Fred Savage, Ministry of Education
Don McColman, Newmont Mines Limited
John Graham, Noranda Mines Limited
Charles Heikkila, Noranda Mines Limited
Les Redord, Noranda Mines Limited
Dennis LeDuc, Placer Development Limited
Larry Hartley, Utah Mines Limited

In addition, the following individuals participated in the review workshop for the *Rotary Drill Operator* outline:

John Cochrane, Noranda Mines Limited
Claude Bourgeois, Placer Development Limited

Field-testing the Haulage Truck Operator Outline

In June 1980 three companies (B.C. Coal Ltd; Noranda Mines Limited, Granisle Mine; Brinco Mining Limited) offered to field-test the new *Haulage Truck Operator* outline for a six month period and report back to the group. During the fall, it was further agreed that the other participating mines in the project would also field-test the outline and would complete a questionnaire. In the winter of 1981 all mines reported that the outline had been used successfully to improve the truck operator training at their mine and some reported making major revisions of their training programs as a result of the outline.

USE OF TRAINING OUTLINES

Additions and Modifications

References are made in the outlines to areas where policies will vary from company to company and it is up to trainers to insert their company policies in these places.

Each training outline is based on a specific manufacturer and model of equipment, for example the rotary drill is a GD-120. In order to use the material for a different manufacturer or model, a trainer must review the outline and make necessary modifications. It is anticipated that only the section on gauges and controls will need major changes.

For Lesson Plans

The outlines do not contain lesson plans. Rather the trainer should use the outlines as a guide when preparing lesson plans both for classroom and on-the-job training activities. Trainers are encouraged to expand upon the outlines to suit their own situation.

For Testing

The outline should also be used as a guideline for written, oral, and practical testing. Trainers should ensure that upon completion of training, each trainee can perform every objective listed in the outline. It will take time and experience on-the-job before a trainee becomes a proficient operator. Regular on-the-job monitoring by supervisors and trainers can greatly assist the trainee in developing and maintaining the skills needed to be a heavy equipment operator.

Sample tests for the outlines have been written and are available to trainers from:

Research & Curriculum Development Branch,
Ministry of Education,
7451 Elmbridge Way,
Richmond, B.C.
V6X 1B8
Telephone: (604) 278-3433

For Trainees

The outlines provide valuable information on operating heavy equipment and give clear statements on what trainees must be able to do by the end of their training. Therefore, it is recommended that trainees be given a copy of both the skill profile chart and the outline.

BASIC SAFETY AND OPERATING RULES

module 1

OBJECTIVE 1-1

The drill operator will explain how safety and operating rules set by the company and the *Mines Regulation Act* protect the operator and fellow workers on the mine site.

KEYPOINTS/PROCEDURES

1. The following are basic safety and equipment operating rules. Individual companies should incorporate their own safety rules into this material.

2. **Personal wear**

   The safety rules concerning personal wear are set for the protection of the drill operator and include proper:

   - Hard hats
   - Footwear
   - Eye protection
   - Hearing protection
   - Gloves

3. **Personal conduct**

   Rules concerning personal conduct are enforced for the safety of all personnel on the mine site and cover:

   - Horseplay.
   - Reading on the job.
   - Alcohol and drugs.

4. **Pre-start check**

   Safety rules ensure personal protection while conducting pre-start checks and also ensure that the drill is in a safe operating condition before it is put into production. Special caution is required when:

   - Working around moving components on the drill.
   - Climbing on or off the drill.

   It is essential to report immediately any operational problems with the drill. The drill must always be equipped with a fire extinguisher.

   Rules 263 (d) and 263 (e) of the *Mines Regulation Act* and rules 195 (d) and 195 (e) of the *Coal Mines Regulation Act* state:

   > (d) The driver or operator of any vehicle or mobile equipment shall examine and test his equipment at the beginning of each shift before putting it into use; and if any unsafe condition is noted, such equipment shall not be used and the immediate supervisor shall be notified.
   >
   > (e) For each vehicle or piece of mobile equipment, a logbook or other suitable record shall be maintained, in which shall be entered a record of all unsafe conditions and the repairs made, and all notations shall be signed by the person making the entry, and the logbook or records shall be available for inspection at all times.

   It is the drill operator's responsibility to comply with these rules.

5. Operating

Operating rules ensure the safety of the drill operator and of all other persons on the mine site.

Only persons authorized by the company are allowed to operate drills.

There are blind areas immediately surrounding the drill. The operator must ensure that the area is clear before moving the drill.

Rule 264 (a) (iii) of the *Mines Regulation Act* and rule 196 (a) (iii) of the *Coal Mines Regulation Act* state:

> No person shall operate or put in motion any vehicle or mobile equipment unless he has just previously inspected on foot the area over which the equipment is to be moved.

The drill operator must immediately follow all warning signals given by others on the mine site including horns, lights and hand signals. These signals are covered in OBJECTIVE 2-1.

6. Traffic control scheme

It is the drill operator's responsibility to obey the traffic control scheme as set out by the company (OBJECTIVE 1-4). Rule 264 (b) of the *Mines Regulation Act* and 196 (b) of the *Coal Mines Regulation Act* both state:

> The owner, agent, or manager of every mine shall prepare a traffic control scheme for his operation and shall have it accepted by the Inspector, and the scheme shall show the maximum allowable speeds for the vehicles in use, rules for passing, "stop" and "yield" locations, priority rules for night operation, maximum operating grades, emergency run-off protection, and such other information as may be required by the Inspector.

7. Servicing

Servicing rules ensure the safety of all persons while servicing the drill. The drill operator must take the following precautions.

- No oiling, greasing, adjusting or repairs are done on moving machinery.
- No oily, greasy rags or cardboard boxes are accumulated on the drill.
- All grease and oil is cleaned up off the floor and walls in both the machine cab and the operator's cab.

Servicing procedures are covered in Module 7.

8. Parking

The operator must obey the following procedures for parking the drill:

a. Position the drill to ensure that it is stable.

b. Make sure the drill pipe or drill string is up and stored.

c. Set all of the controls in the off or neutral position.

d. Lower the drill onto the tracks and off of the jacks.

e. Set the propel brake.

OBJECTIVE 1-2

The drill operator will explain the importance of reporting accidents and injuries.

KEYPOINTS/PROCEDURES

1. **Accidents**

   All accidents must be reported to the supervisor as soon as possible. In the event of a serious accident, do not disturb the accident scene unless there is a risk of further damage or a danger to personnel.

2. **Injuries**

   All injuries, no matter how slight, must be reported to the supervisor and to the first aid station. Any injury where the skin is broken must be treated to avoid infection. In cases of serious injury, do not move the victim — send for the first aid attendant.

3. **Investigations**

   Reporting accidents and injuries makes way for an investigation to be carried out to determine the cause. These investigations often lead to new rules or procedures that create a safer working environment for all employees.

   Note:

   It is the responsibility of all employees to report any hazardous condition to their supervisors immediately.

OBJECTIVE 1-3

The drill operator will describe the changing conditions that can occur at the mine site and explain the importance of staying alert to these changes.

KEYPOINTS/PROCEDURES

1. **Weather**

   Rain, snow and fog each have an effect on the operator's visibility. Additional caution is required while operating under poor weather conditions.

2. **Other equipment**

   The drill operator must be alert at all times to other equipment working or travelling in the area. The drill's prime function is drilling holes for blasting, and often the work is performed near haul roads.

3. **Traffic control scheme**

   The drill operator must be aware that a traffic control scheme exists and that there is the possibility of it changing from time to time.

4. **Working conditions**

   Working conditions change around the drill. Moving equipment and increased activity make it necessary for the operator to be aware of the working conditions while drilling.

5. **Drill performance**

   An alert drill operator can determine a change in the drill's performance by sound and by comparing how the drill reacts under normal working conditions. For example, the drill operator can tell if the drill is responding properly or not.

6. **Light**

   The change from daylight to darkness and vice-versa creates operating conditions that demand added attention and alertness.

OBJECTIVE 1-4

The drill operator will describe the traffic control scheme at the mine site.

KEYPOINTS/PROCEDURES

1. **Right of way**

   The right of way priority system can change from property to property. An example of a right of way priority system is:

   a. Ambulance, rescue or fire trucks.

   b. Buses.

   c. Road maintenance equipment (graders).

   d. Loaded production trucks.

   e. Empty production trucks.

   f. Explosive trucks and fuel trucks.

   g. All other trucks or equipment (dozers).

   h. Any equipment being towed such as drills.

   Caution:

   A set of right of ways provides guidelines, but all operators must use judgement in all circumstances. Remember, a right of way can only be given, it cannot be taken.

2. **Traffic signs**

   Obey traffic signals and signs including stop signs and yield signs.

3. **Merging traffic**

   Merging traffic must yield to through traffic unless otherwise informed by the supervisor.

4. **Changing road systems**

   When road systems change, drill operators must be forewarned and also advised as to which traffic has the right of way. Drill operators should always give way to faster moving equipment.

5. The drill operator is not involved with the traffic control system while operating the drill, other than in towing or travelling on haul roads.

OBJECTIVE 1-5

The drill operator will explain both normal and emergency braking procedures for stopping the drill.

KEYPOINTS/PROCEDURES

1. **Normal braking**

   For normal braking the drill operator has four choices:

   - Place the hoist/propel speed control into neutral.
   - Place the propel clutch control into neutral.
   - Place the propel position/electric hoist/drilling position control into neutral.
   - Press the hoist/propel and rotary control stop button.

2. **Emergency braking**

   The drill operator, in an emergency braking situation, can:

   - Place the hoist/propel speed control into neutral.
   - Place the propel clutch control into neutral.
   - Place the propel position/electric hoist/drilling position control into neutral.

3. The drill operator can stop the drill immediately by placing any one or more of these controls into neutral. There is also a switch mounted on the outside of the drill, at the top of the stairs, that a ground person or oiler can use to stop the drill from moving in the event of an emergency.

4. If the propel chain breaks, lower the jacks or drill string to stop the drill.

5. If moving the drill on a grade, use a track dozer for back-up in case of loss of braking.

OBJECTIVE 1-6

The drill operator will explain the procedures for shutting down the drill in the case of an emergency.

KEYPOINTS/PROCEDURES

1. In an emergency the drill operator must press the all power off control. This control trips the power to off right back to the electrical switch house.
2. For drills that are not equipped with the all power off control, the drill operator must press the DC control off button.
3. There may also be an outside key that can be used to kill the power to the drill in an emergency situation.

OBJECTIVE 1-7

The drill operator will explain why it is important to maintain good housekeeping practices.

KEYPOINTS/PROCEDURES

1. The importance of good housekeeping is to maintain a safe and pleasant environment to work in. Employees have the responsibility to keep their work area in good condition. Good housekeeping is an essential part of each employee's job. A disorderly and dirty work area can cause accidents, personal injuries and low morale. Good housekeeping on the drill is essential for safety and efficiency and includes the following:

   - Keep all windows and mirrors clean for good visibility.
   - Keep the dash clean, primarily the indicators, so that they can be accurately read.
   - Keep the cab clean of all paper, rags, dirt, mud and aerosol cans.
   - Keep the deck clear of mud, dirt and grease.
   - Cleanup grease and oil on the floor and walls, in both the operator's cab and in the machine room.
   - Keep all walkways and stairs free of mud, snow or any obstructions that can cause a slip or a fall.
   - Never store any materials in the high voltage room.

   Caution:

   Aerosol cans can cause serious injuries by exploding. Store the cans in a cool area within the machine room. All other materials used for servicing, such as rags, grease and oil should be properly stored away.

OBJECTIVE 1-8

The drill operator will explain the mine site blasting and guarding procedures.

KEYPOINTS/PROCEDURES

1. The blasting procedure is enacted on the day of the blast. Employees should be notified of the blast, although this notification is not the final precaution. Before blasting, the supervisor makes a careful physical check of the area to ensure that no one is there. All employees are evacuated to a safe distance. All access roads are closely guarded to prevent access into the blast area.
2. The guards have the responsibility to stop anyone from entering the blast area. Guards are visibly identifiable by a colored vest issued by supervision. They remain at the location designated by supervision, until relieved by the person who designated them as guards.
3. Should any irregularities occur, it is the guard's responsibility to immediately notify the blasting foreman of the problem.
4. Frequently, the drill operator is used as a guard. Each company has its own procedure to ensure that the guard is able to prevent access to the blast area.

OBJECTIVE 1-9

Given a map of the pit area layout, the drill operator will give the proper names of pits and haul roads and will locate the drill areas by name or number.

KEYPOINTS/PROCEDURES

1. Each property is different in layout, and in the names and numbers of the dumps, pits, etc.
2. Some properties may also want employees to know the drill and shovel locations.

OBJECTIVE 1-10

The drill operator will explain and demonstrate the proper use of fire extinguishers and fire suppression systems.

KEYPOINTS/PROCEDURES

1. **Fire extinguishers**

   All drills are equipped with a hand fire extinguisher. Shut down the drill before using the fire extinguisher. Aim the dry chemical flow at the base of the fire and move the flow from side to side. This side to side action forces the flames away from the source and has a cooling effect. The chemical cuts off the oxygen at the source of the flame and puts out the fire.

2. **Fire suppression systems**

   The fire suppression system consists of dry chemical tanks mounted on the drill, with a pressure source to distribute the chemical powder. Hoses run from the tanks to nozzles at all critical areas of the drill. The operator manually pulls a button that releases the pressure sources and the chemical is spread as desired. This can be performed either from the cab or from the ground.

   Some systems are designed with a heat-sensing device and discharge automatically at a pre-set temperature.

3. Speed is the important factor in combating a drill fire. First shut down the drill. Suppress the fire quickly and avoid being faced with a widely spread fire that is difficult to contain. Heat remaining from the initial fire can cause re-ignition. Stand at a safe distance with a portable hand extinguisher until all danger of re-ignition is past.

OBJECTIVE 1-11

The drill operator will describe a miss-hole and state the procedures for reporting the location of a miss-hole.

KEYPOINTS/PROCEDURES

1. A miss-hole is a drill hole that was loaded with explosives which did not explode during the blast, leaving the hole still full of powder.
2. The drill operator noticing a miss-hole from a previous blast must notify the supervisor immediately. Properly mark the miss-hole and do not operate within 25 feet without direct supervision.

OBJECTIVE 1-12

The drill operator will explain the importance of keeping personnel off of the drilling platform during operation of the drill.

KEYPOINTS/PROCEDURES

1. No personnel should be standing on the drill platform during the drilling operation. There is a chance that the pulldown chains could break, bolts could fall, braces could break etc. causing bodily harm to anyone standing on the drill platform.

OBJECTIVE 1-13

The drill operator will explain the company's power cable handling policy.

KEYPOINTS/PROCEDURES

1. Each company should establish a power cable handling policy to be followed by all personnel handling power cable. The policy should include the following precautions:
   - 10,000 volt hot gloves and other approved protective devices must be used at all times when handling power cable. Do not step on power cable or allow power cable to come in contact with any other part of the body. Inspect the hot gloves before use and discard them if they are defective. Do not use hot gloves if they are wet inside. Hot gloves must be covered with leathers and should not be used for any purpose other than handling power cable.
   - All power cable attached to sub-stations or switch houses must be treated as energized.
   - Never place any part of the body, even if protected by hot gloves, on or near cable terminals located inside potheads and junction boxes.
   - No one, other than an authorized person, is to energize, de-energize, connect or disconnect power cables.
   - Cable arches must be treated the same as power cable when the cable over the arch is connected to a sub-station or switch house. Report any cuts or bruises in the cable. Do not handle damaged power cable unless it has been checked by an authorized person. Only qualified electricians are authorized to make repairs to power cables.
   - Never run over unprotected power cable with any vehicle or piece of equipment.
   - Never pull more than 75 feet of power cable in a single pull. Power cables can be damaged by stretching.
   - When junction boxes and potheads are being moved, they must be adequately supported and kept clear of the pit floor. Rough handling of junction boxes can cause damage to the boxes and to the power cable by the flexing of the cables at the boxes.
   - Disconnected power cable retains a residual charge of about 110 volts. Caution must be used when handling disconnected cable.
   - The input side (hotside) of the switch house must be padlocked, if it is a pothead so that it cannot be removed.

OBJECTIVE 1-14

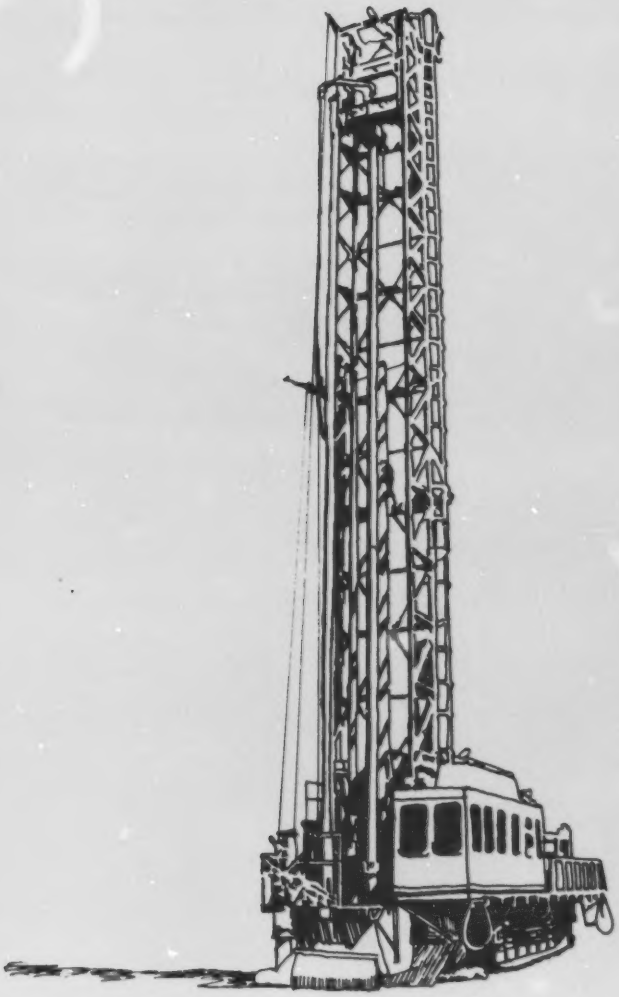
The drill operator will explain the company's lock-out procedures.

KEYPOINTS/PROCEDURES

1. To ensure the safety of maintenance and operating personnel, the company should establish a procedure for locking-out equipment, to be followed by all personnel.
2. Locking-out equipment means that wherever the possibility of equipment starting, energizing, or moving exists, which can create a hazardous situation, that piece of equipment should be locked-out and tagged by the operator. A lock-out procedure is designed to prevent accidents and personal injury. Never remove another worker's padlock or tag without authorization. Check with the supervisor for instructions.
3. The drill operator is required to know the location of the lock-out station for the drill, and must always check the station for padlocks or "do not operate" tags before starting the drill.

COMMUNICATIONS

module 2



OBJECTIVE 2-1

The drill operator will describe the signals used by ground personnel.

KEYPOINTS/PROCEDURES

1. A signal for HELP WANTED should be established at the property and all of the employees informed of it.
2. The drill operator must demonstrate the hand, light and horn signals used by other personnel.
3. There must be a set of signals established between the drill operator and personnel outside of the drill, during a drill move. To ensure a safe move, the communications between the driller and the ground personnel is of the utmost importance.
4. Each company should establish a set of hand and light signals for nighttime use at the property.

OBJECTIVE 2-2

Given a sample of the reporting forms used by the company, the drill operator will complete production reports, timecards, and the daily logbook.

KEYPOINTS/PROCEDURES

1. **Production reports**

   The production reports are to be filled out to include the:

   - Area code number of the pit in which the drill operator is working.
   - Code number of the type of work being done by the drill.
   - Equipment number of the drill that the operator is using.

   Production reports are used for costing and planning purposes. Therefore it is imperative that they be accurate.

2. **Timecards**

   Timecards should include the:

   - Area code number of the pit in which the drill operator is working.
   - Code number of the type of work being performed.
   - Equipment number of the drill that the operator is using.

3. **Daily logbooks**

   The daily logbooks are filled out regularly and cover the following information:

   - General repairs to the drill.
   - Any general information for example on steering, brakes and safety items which can help the oncoming operator.
   - Information on the drill bit life (as required by company policy).

4. **Drill bit record**

   In order to monitor the life of the bit, it is essential to keep a detailed record for each drill hole including the hole number, hole depth, drilling time, rpm, down pressure, air pressure, ground hardness, bit make and serial number. Rule 263 (e) of the *Mines Regulation Act* and rule 195 (e) of the *Coal Mines Regulation Act* state:

   > For each vehicle or piece of mobile equipment, a logbook or other suitable record shall be maintained, in which shall be entered a record of all unsafe conditions and the repairs made, and all notations shall be signed by the person making the entry, and the logbook or records shall be available for inspection at all times.

5. It is important that the oncoming operator knows the prior shift's history of the drill. Operators should report unsafe equipment conditions first of all to the supervisor and then to the oncoming drill operator.

OBJECTIVE 2-3

The drill operator will operate the mobile radio on the mine site and explain the proper procedures for its use.

KEYPOINTS/PROCEDURES

1. Proper and effective use of the radio is important. Take the following steps:
   a. Identify the sender by unit or vehicle number.
   b. Identify the receiver by unit or vehicle number.
   c. Wait until the receiver acknowledges.
   d. Relay the message in a clear and precise manner.
   e. State whether the call is an emergency or not.
2. Radio use is restricted to necessary operational transmissions. Use no profane language over the radio at any time.
3. In the event of an unsafe situation or an emergency, contact the dispatcher or supervisor immediately. If radio silence is necessary, either the dispatcher or the immediate supervisor can call for it. This depends on the procedures established at the mine.

OBJECTIVE 2-4

The drill operator will explain the different survey stakes used at the mine site.

KEYPOINTS/PROCEDURES

1. Companies have their own color and flagging codes and should include this information.

2. **Drill hole stakes**

   Drill hole stakes locate the position of a drill hole. On the stake is the number of the blast hole and the depth it is to be drilled. These stakes are retained after drilling, for loading information.

3. **Drill limit stakes**

   Drill limit stakes mark the drill boundary in order to avoid unnecessary drilling.

4. **Blast boundaries**

   Blast boundary stakes indicate the limit of cleanup required to start drilling a new blast area, and possibly the limit of digging of the previous blast.

5. **Loaded blast area boundaries**

   Loaded blast area boundary stakes indicate a loaded blast area. The stakes are red in color. No equipment should enter this area.

6. **Digging limit stakes**

   Digging limit stakes indicate the limit the digging is to go.

7. **Primary control points**

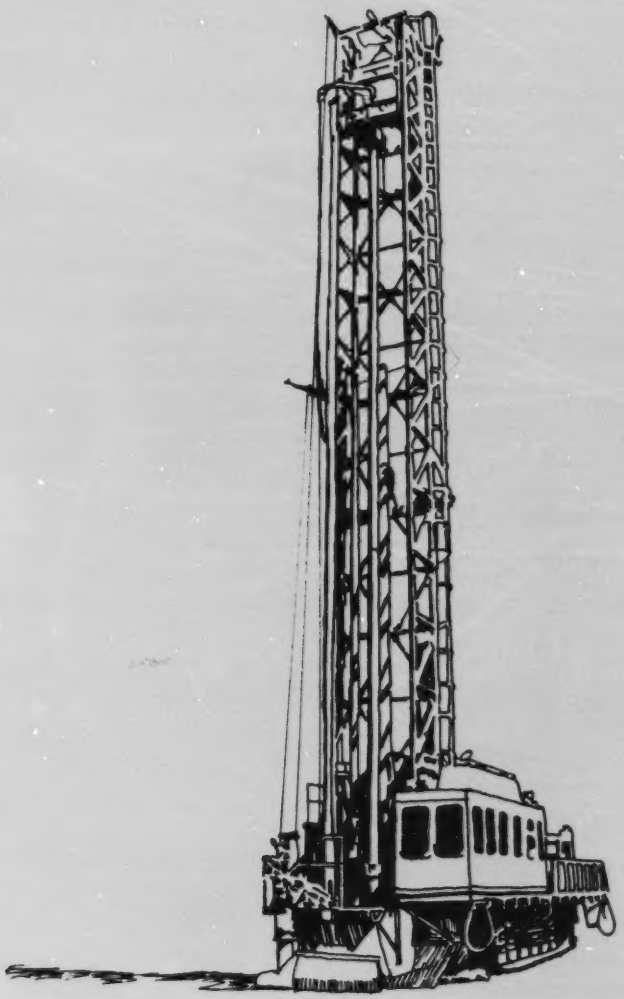
   The primary control point is the basis for all survey work in the area and is set with the utmost accuracy.

8. **Secondary control hubs**

   Secondary control hubs are set from the primary control point and are the basis of all the actual field work.

INDICATORS AND CONTROLS

module 3



OBJECTIVE 3-1

The drill operator will locate and identify the gauges, indicators, controls and switches in the cab area.

KEYPOINTS/PROCEDURES

1. The gauges and indicators include:
   - Rotary motor rpm gauge.
   - Rotary motor load current gauge.
   - Hoist/propel motor and rotary motor temperature light.
   - Pipe rack secure light.
   - Depth counter.
   - Lube power on light.
   - Main machine fault light.
   - Propel machine fault light.
   - Auxiliary air gauge.
   - Main air gauge.
   - Bit air pressure gauge.
   - Hydraulic pressure gauge.
   - Load or bit gauge.
   - Water sight gauge.
   - DC buss ground light.
   - Stairway down light.
   - Hydraulic oil level gauge (house area).
   - Main compressor oil level gauge (house area).

2. The controls and switches include:
   - Cab fan heater control.
   - Pressurized water injection control.
   - Water injection flow control.
   - Control air switch.
   - Air horn valve.
   - Hydraulic pump buttons.
   - Hoist/propel and rotary control buttons.
   - Main air compressor start button.
   - MG set stop button.
   - Automatic pulldown switch.
   - Pull down selector control.
   - Rotary speed control.
   - Hoist/propel speed control.
   - Propel position/electric hoist/drilling position control.
   - Rotary speed selector control.
   - Mast down/up control.
   - Mast anchor pins control.
   - Mast back braces control.
   - Auxiliary winch control.
   - Left hand pipe rack control.
   - Casing tongs control.
   - Pulldown selector switch.
   - Left hand jack control.
   - Right hand jack control.
   - Front jacks control.
   - Dust curtain control.
   - Tool wrench control.
   - Left hand pipe latch control.
   - Hoist/pulldown clutch control.
   - Main air control.
   - Pulldown chain button.
   - Pulldown control.
   - Cab heater thermostat.
   - Outside emergency stop switch.
   - All power off button.
   - Propel clutch control.

OBJECTIVE 3-2

The drill operator will describe the gauges, indicators and warning signals and explain the action to take if a signal appears.

KEYPOINTS/PROCEDURES

1. **Rotary motor rpm gauge**

   The rotary motor rpm gauge indicates the bit rpm in forward motion.

2. **Rotary motor load current gauge**

   The rotary motor load current gauge indicates the load current in amperes on the rotary motor in both forward and reverse motion.

3. **Hoist/propel motor and rotary motor temperature light**

   The hoist/propel motor and rotary motor temperature light is a green light that indicates that the hoist/propel motor and rotary motors are operating within a safe operating range. Should the light go out during operation, it indicates that the hoist/propel motor or the rotary motor or both are overheating. The motors stop running automatically. Once the motors cool, the light comes back on and the motors can be used again. If the condition of the light going off and the motors shutting down persists, notify the supervisor so that the problem can be rectified.

4. **Pipe rack secure light**

   The pipe rack secure light is a green light that indicates that the pipe rack is back and locked. The light only works when the hoist/propel and rotary controls are on. If the pipe rack secure light does not come on when the hoist/propel and rotary controls are on, it indicates that the pipe rack is not locked and secure.

5. **Depth counter**

   The depth counter shows by a digital readout, the depth of the hole being drilled (in feet).

6. **Lube power on light**

   The lube power on light indicates that the lubrication system power is on.

7. **Main machine fault light**

   The main machine fault light indicates an electrical fault in the main machine. Should there be an indication, shut the drill down and notify the supervisor in order to have the problem investigated.

8. **Propel machine fault light**

   The propel machine fault light indicates an electrical problem in the propel system of the drill. Should there be an indication, shut the drill down and notify the supervisor in order to have the problem investigated.

9. **Auxiliary air gauge**

   The auxiliary air gauge indicates the air pressure in the auxiliary control air system.

10. **Main air gauge**

    The main air gauge indicates the air pressure in the main air compressor system.

11. Bit air pressure gauge

The bit air pressure gauge indicates the amount of air pressure being applied to the bit for bailing.

12. Hydraulic pressure gauge

The hydraulic pressure gauge indicates the hydraulic oil pressure in the main hydraulic system.

13. Load or bit gauge

The load or bit gauge indicates the amount of pulldown pressure or load put onto the bit. The gauge takes into consideration the weight of the rotary drive machining and fifty feet of drill pipe.

14. Water sight gauge

The water sight gauge indicates the amount of water flow injected into the bailing air system.

15. DC buss ground light

The DC buss ground light indicates an electric ground on the DC electrical system of the drill. Should there be an indication shut the drill down and notify the supervisor for further investigation into the problem.

16. Stairway down light

The stairway down light indicates that the stairs at the front of the drill are down. If the stairs are down the drill cannot propel. If during propelling, the drill stops and the light comes on, investigate the problem.

17. Hydraulic oil level gauge (house area)

The hydraulic oil level gauge is a sightglass. The oil level must be at the mast up and jacks fully extended level which is marked on the hydraulic tank alongside the sightglass. This level marks that the mast is up and that the levelling jacks are fully extended. If the level is low, bring it up to that mark; if it is higher than the mark, have some oil taken out to bring it down to the mark.

18. Main compressor oil level gauge (house area)

The main compressor oil level gauge is red and green color coded. Green is in the middle of the gauge with red markings on either side. If the gauge is to the left of the green and in the red, oil must be added. If the needle is to the right of the green mark and in the red, the oil level is too high and oil must be drained away.

Note:

The last two gauges are situated in the drill house area, not in the operator's cab, and must be checked during the shift.

OBJECTIVE 3-3

The drill operator will describe the function of each of the controls and switches.

KEYPOINTS/PROCEDURES

1. **Cab fan heater control**

   The cab fan heater control turns on or off the heat in the operator's cab.

2. **Pressurized water injection control**

   The pressurized water injection control turns on or off the water from the pressurized reservoir. The water flows to the venturi, which works in conjunction with the water injection flow control.

3. **Water injection flow control**

   The water injection flow control, decreases or increases the amount of water injected into the bailing air system.

4. **Control air switch**

   The control air switch turns the control air, and auxiliary compressors on or off. This provides the air pressure needed for the drill.

5. **Air horn valve**

   The air horn valve blows the horn when the button is pressed.

6. **Hydraulic pump buttons**

   The hydraulic pump buttons start or stop the hydraulic pump unit when the buttons are pressed.

7. **Hoist/propel and rotary control buttons**

   The hoist/propel and rotary control buttons either energize or deactivate the circuits to the hoist/propel and rotary motors when the buttons are pressed.

8. **Main air compressor start button**

   The main air compressor start button starts the main air compressor when the button is pressed. The button should be held in until the low oil warning light goes out. The start button is located on the electrical panels in the walkway of the machine house.

9. **MG set stop button**

   The MG set stop button shuts down both the MG set drive unit and the main air compressor when the button is pressed.

10. **Automatic pulldown switch**

    The automatic pulldown switch engages or disengages the automatic pulldown system.

11. **Pulldown selector control**

    The pulldown selector control selects the position of operation; up, down or collar. This control operates in conjunction with the automatic pulldown switch.

12. **Rotary speed control**

    The rotary speed control designates the direction and speed of the rotary motor.

13. **Hoist/propel speed control**

The hoist/propel speed control designates the speed and direction of the hoist/propel motor. In the hoist position it controls the speed and lowering or raising of the rotary head. In the propel position it controls the speed and direction the drill travels.

14. **Propel position/electric hoist/drilling position control**

The propel position/electric hoist/drilling position control controls the propel, hoist and drilling. The control is used in conjunction with the following controls:

- In propel position it is used with the propel clutch control.
- In electric hoist position it is used with the hoist/propel speed control and the hoist/pulldown clutch control.
- In drilling position it is used with the hoist/pulldown clutch control and the pulldown selector switch.

15. **Rotary speed selector control**

The rotary speed selector control controls the speed and torque of the rotary motor.

16. **Mast down/up control**

The mast down/up control raises or lowers the drill mast.

17. **Mast anchor pins control**

The mast anchor pins control retracts or inserts the drill mast anchor pins.

18. **Mast back braces control**

The mast back braces control controls the sleeve that locks or unlocks the mast back braces.

19. **Auxiliary winch control**

The auxiliary winch control controls the direction and speed of the auxiliary winch.

20. **Left hand pipe rack control**

The left hand pipe rack control controls the movement of the pipe rack for the storage of the drill steels and also to align the steels with the rotary head.

21. **Casing tongs control**

The casing tongs control controls the movement of the casing tongs by extending or retracting the hydraulic cylinders.

22. **Pulldown selector switch**

The pulldown selector switch selects the position of operation; pulldown, hoist or neutral.

23. **Left hand jack control**

The left hand jack control controls the movement of the left hand jack, up or down.

24. **Right hand jack control**

The right hand jack control controls the movement of the right hand jack, up or down.

25. **Front jacks control**

The front jacks control controls the movement of both front jacks, up or down.

26. **Dust curtain control**

The dust curtain control controls the raising or lowering of the dust curtains.

27. **Tool wrench control**

The tool wrench control controls the movement of the tool wrench by retracting or extending the wrench clamp.

28. **Left hand pipe latch control**

The left hand pipe latch control releases the left hand pipe rack control so that it can be operated.

29. **Hoist/pulldown clutch control**

The hoist/pulldown clutch control controls the engaging and releasing of both the brakes and the clutch.

30. **Main air control**

The main air control controls the bailing air on or off.

31. **Pulldown chain button**

The pulldown chain button controls and energizes the lubrication spray system for the pulldown chains.

32. **Pulldown control**

The pulldown control increases or decreases the pulldown pressure on the rotary head.

33. **Cab heater thermostat**

The cab heater thermostat controls the temperature as set in the operator's cab.

34. **Outside emergency stop switch**

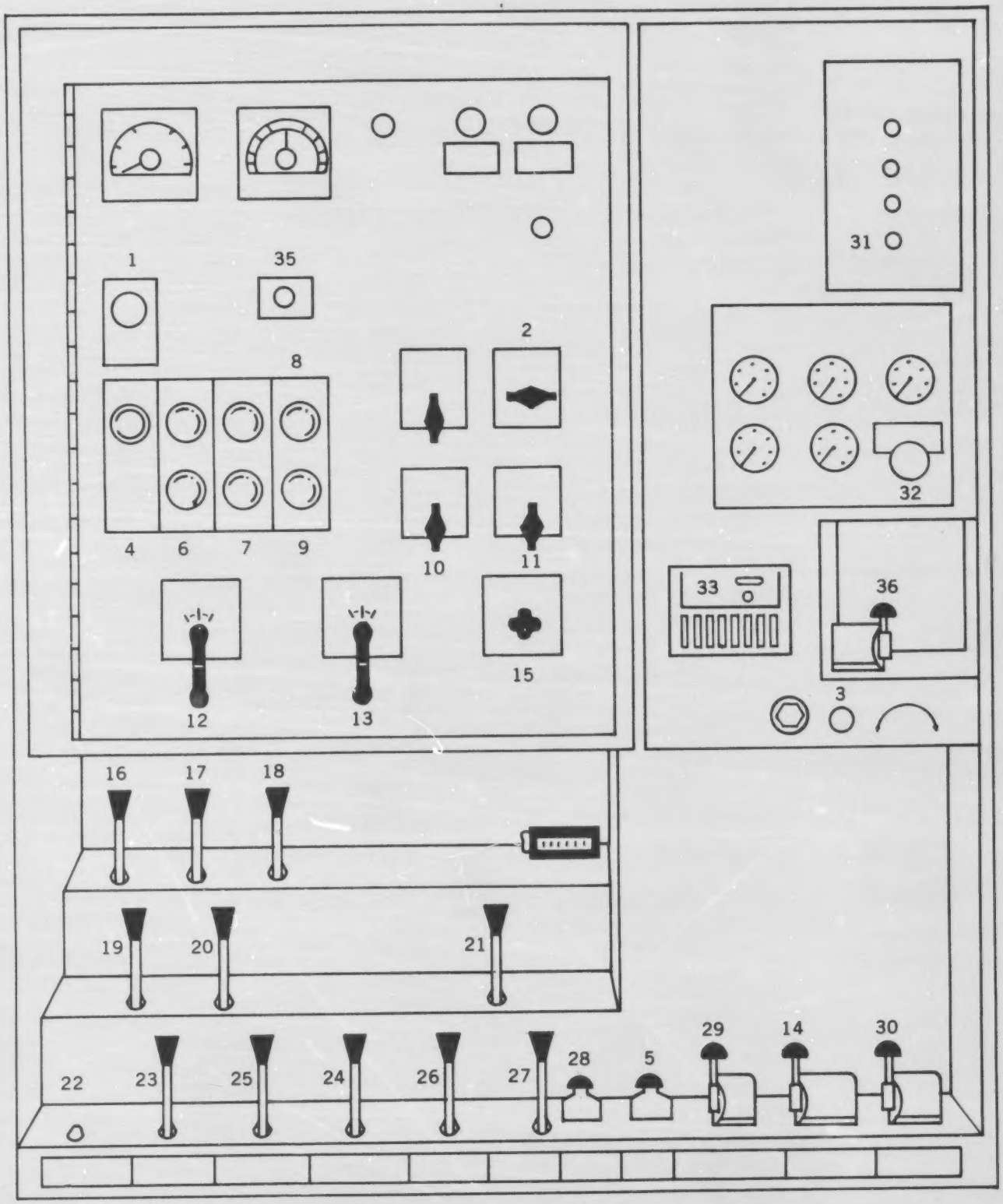
The outside emergency stop switch is a switch that controls stopping the movement of the drill from outside of the cab. It is mounted at the top of the stairs on the front of the drill (opposite end to where the mast is mounted).

35. **All power off button**

The all power off button, when pushed, cuts off all power to the drill back to the electrical skid shack.

36. **Propel clutch control**

The propel clutch control lever controls the braking and engaging of either the left or right track for turning purposes and also engages the tracks for moving straight ahead or back. The control is used with the propel/electric hoist/drilling position control in the propel position.



34. *Objective 3-3*

PRE-START AND OPERATIONAL CHECKS

module 4

OBJECTIVE 4-1

The drill operator will locate and identify the basic units and related components on the drill.

KEYPOINTS/PROCEDURES

1. **Main frame**

   The main frame consists of beams welded together with a steel floor placed on top. Attached directly to the main frame are the:

   - Hydraulic levelling jacks.
   - Crawler or track assembly.
   - Machinery house.
   - Cab.
   - Mast and drill assembly.

2. **Crawler or track assembly**

   The crawler or track assembly consists of the:

   - Crawler or track frame.
   - Drive sprocket.
   - Front idler.
   - Guide rollers.
   - Drive chains.
   - Axles.
   - Crawler or track pads.
   - Pins.

3. **Machinery house**

   The machinery house includes the:

   - Main air compressor system.
   - Auxiliary air compressing system.
   - Hydraulic tank and pumps.
   - Lubrication system.
   - Electrical cabinets.
   - Pressurization system.

4. **Cab**

   The cab includes the:

   - Gauges and indicators.
   - Controls.

5. **Mast and drill assembly**

   The mast and drill assembly consists of the:

   - Mast.
   - Rotary drill head.

- Deck.
- Tool wrench.
- Pipe racks.

OBJECTIVE 4-2

The drill operator will locate in a systematic sequence, the pre-start and running check points on the drill.

KEYPOINTS/PROCEDURES

1. The drill pre-start and running check points are:
   - Check the cab for warning flags, lockout tags and read the logbook.
   - Chain the drill.
   - Power cable.
   - Pad pin.
   - Levelling jacks.
   - Lubrication hoses and hydraulic lines.
   - Crawler assembly.
   - Back levelling jacks.
   - Mast pins.
   - Dust curtains.
   - Power cable storage.
   - Stairs.
   - Handrails.
   - Main air compressor oil level.
   - Grease system.
   - Hydraulic tank level.
   - Auxiliary air compressor oil level.
   - Air compressor belts.
   - Main machinery unit.
   - Hydraulic lines.
   - Tool wrench.
   - Rotary head.
   - Mast and pulldown chains.
   - Mast cylinders.
   - Mast braces (stabilizer arms).
   - Bit and stabilizer.
   - Drill pipe.
   - Pipe racks.
   - Air tank.
   - Safety sling.
   - Sand winch (auxiliary line).

OBJECTIVE 4-3

The drill operator will perform a pre-start check of the drill and describe both the acceptable conditions for each check point and the problems that should be reported to a supervisor.

KEYPOINTS/PROCEDURES

1. **Check the cab for warning flags, lockout tags and read the logbook**

   Before commencing the pre-start check, inspect the cab area for other operators, warning flags or lockout tags and review the logbook entries. Also check to ensure that there are no personnel working under or in the immediate vicinity of the drill.

2. **Claim the drill**

   Claim the drill to make sure that no one else moves it. Leave a lunch bucket or some other visual indicator to identify that the drill is in use.

3. **Power cable**

   Check the power cable to make sure that it is tied up out of the way of the tracks. The surplus cable should be stored away on the cable rack on the side of the drill. The cable on the ground should be strung out properly, making sure to keep it out of the way of the tracks. Look for bad cuts in the cable.

   Caution:

   When handling power cable, always use electrical hot gloves or other approved protective devices.

4. **Pad pin**

   Check the pin that attaches the pad to the bottom of the levelling jacks. The pin can work loose and the pad falls off.

5. **Levelling jacks**

   Check the levelling jacks. There are four jacks, two on each end of the drill and one in each corner. Check the jacks to make sure that they are getting grease. If there are shining metal parts visible on the shaft, one of the lube-lines could be damaged. Check the bottom side of the pad for the build-up of snow, ice or mud.

6. **Lubrication hoses and hydraulic lines**

   Check the lube and hydraulic lines leading to the levelling jacks to make sure that they are all in good condition and not leaking. Report any leaking hoses.

7. **Crawler assembly**

   Check the crawler assembly for:

   - Proper tension of the track adjustment.
   - Crawler pads that are cracked or broken.
   - Crawler pad pins that are working loose.
   - Breaks and cracks in the crawler frame.
   - Guide rollers that are running free and not plugged with dirt.
   - Wear to the drive tumbler and make sure that it is not plugged up with dirt.
   - Wear to the take up or front tumbler and make sure that it is not plugged with dirt.

- Loose or missing bolts on the rear axle bearing cover.
- Proper tightness of the drive chain and that it is not wearing out.
- Worn or broken teeth on the sprockets.
- Loose or broken U-bolts. U-bolts hold the axles to the main frame.

8. **Back levelling jacks**

   Check the back levelling jacks to make sure that they are getting grease and that the pad pin is not working loose. Also, check the hydraulic and lube lines to the jacks for leaks or damage. Check the bottom side of the pad for the build-up of snow, ice or mud.

9. **Mast pins**

   Check the mast pins to make sure that they are in place. The pins are attached to the hydraulic cylinder that retracts or inserts the pin.

   Check the hydraulic cylinder connection points to ensure that they are in good condition and that there are no leaks on the hydraulic lines.

10. **Dust curtains**

    Check the dust curtains to make sure that they are in good condition. If the rubber is ripped, have it replaced. A hydraulic cylinder controls the movement of the curtains. Make sure there are no hydraulic leaks in this area and that there are no worn connection points. There is a cable that is attached to both the cylinder and the curtain. Make sure the cable is not worn and that it is in good condition.

11. **Power cable storage**

    Check the power cable cable storage area which is mounted on the cab side of the drill. Make sure the cable is stored properly. Also, check for bad cuts in the cable. This is a visual check only.

12. **Stairs**

    Check that the stairs leading into the drill are in good condition and that they are clean of mud, ice or snow build-up. The stairs must be free of anything that can cause either a slip or a fall.

13. **Handrails**

    Check the handrails for general condition and also make sure that they are clean.

14. **Main air compressor oil level**

    Check the main air compressor oil level. It is a gauge that is red and green color coded. The green is in the middle of the gauge with red markings on either side. If the gauge is to the left of the green and in the red, oil must be added. If the needle is to the right of the green mark and in the red, the oil level is too high and oil must be drained away.

15. **Grease system**

    Check the lubrication barrels used in the grease system. Make sure that the grease level in the barrels is proper and replace any empty barrels. Check all of the lubrication lines for leaks or broken lines.

16. Hydraulic tank level

Check the hydraulic oil tank level in the sightglass. There are different markings to the side of the sightglass. For example, with the mast up and levelling jacks down, the oil level must show that specific marking. If it is lower than the marking, add oil to bring it up. If the oil is too high have some drained off.

17. Auxiliary air compressor oil level

The oil level in the auxiliary air compressor is checked with a dipstick. If the oil level is on the "add" mark, bring the oil up to the proper level immediately, before going into production.

Caution:

Never service the air compressor until the power is switched off.

18. Air compressor belts

Check the air compressor belts to ensure that they are in good condition and adjusted properly for tightness.

19. Main machinery unit

Check the main machinery unit that is housed in the machine house. This unit is behind a screened off area. To inspect the main machinery unit, a door has to be opened. The door automatically shuts down the drill when it is opened. Check all of the drive chains and sprockets for both the propel and hoist machinery. Look at the general condition of the sprockets, checking especially for worn or broken teeth. Check all lubrication points. Once the inspection is complete make sure that the door is secured properly. If it is not, the drill cannot be started.

20. Hydraulic lines

Check the main machine room for breaks or leaks in the hydraulic lines. Have any leaks looked at immediately. The main machine room is located between the operator's cab and the machine house.

21. Tool wrench

Check the tool wrench on the drill deck. Inspect the tool wrench connection points to ensure that they are in good condition. Also, check the hydraulic lines for leaks and wear. Check the dogs on the end of the tongs to make sure that they are not worn out.

22. Rotary head

Check the rotary head. There are six grease nipples that must be greased every shift. Make a general inspection of the rotary head looking for any cracks or breaks. Check the hydraulic hoses for leaks or signs of wearing. Make sure that they are hanging out of the way so that they are not damaged. Check the rotary head sightglass to make sure that there is no water in the gear oil. If water is found have the gear oil changed.

23. Mast and pulldown chains

Check the general condition of the mast. Check to make sure that the power cables, air hose and hydraulic lines are all out of the rotary head travel way. Check the pulldown chains to ensure that they are running free and are properly adjusted.

24. **Mast cylinders**

Check the mast hydraulic cylinders to ensure that the anchor pins and keepers are not working loose. Make sure all of the hoses are in good condition with no leaks.

25. **Mast braces (stabilizer arms)**

Check the mast braces or stabilizer arms to ensure that the anchor pins are in place and that they are not working loose. Hydraulic cylinders on the braces move the sleeve that locks or unlocks the mast brace. Make sure that there are no hydraulic leaks on the cylinder that controls the movement of the braces. Also, look at the hydraulic cylinder connection points to make sure that they are not working loose.

26. **Bit and stabilizer**

Check the stabilizer for wear and general condition. Make sure that the bushings and rollers are okay and that all three rollers still turn. Check that there are no cracks in the stabilizer body in the pin area. Make sure the three cones on the bit rotate and that the bearings are in good condition. Also, check to see if any buttons have broken off. Look for loose or missing nozzles and make sure that the air flow is not restricted.

27. **Drill pipe**

Check the drill pipe connection points for air leaks and also check the threads for wear.

28. **Pipe racks**

Check the pipe racks to ensure that they are locked back into place. Also, check for twisted racks. If any racks are twisted the rotary head can hit them. Have any twisted racks replaced.

29. **Air tank**

Drain the main air tank at least once every shift.

30. **Safety sling**

Check that the safety sling is necessary and that it is in good condition.

31. **Sand winch (auxiliary line)**

Check that both the line and the hook are in good condition.

OBJECTIVE 4-4

The drill operator will perform proper start up and shut down procedures.

KEYPOINTS/PROCEDURES

1. **Start up**

   Follow these procedures to start the drill:

   a. Check for personnel in the immediate area of the drill. Check the machine room for personnel.

   b. Check to make sure that all machinery is clear of rags, hand tools or anything that can get jammed in the rotating machinery.

   c. Check the drill for warning or lockout tags.

   d. Check the logbook for entries that indicate a problem.

   e. Check to see that the controls are in the neutral position and that no switches or buttons are in the activated position.

   f. Push the MG start button and start the motor generator.

   g. Push the main air compressor start button to start the main air compressor and hold it until the low oil pressure warning light goes out. Both of these buttons are located on electrical cabinets in the walkway in the machine room.

   h. Check to ensure that the main air control is in the off position.

   i. Check the main air pressure gauge to ensure that it levels off at the proper psi depending on the drill, bit and drilling conditions.

   j. Place the control air switch in the on position and the auxiliary compressor should start.

   k. Check to ensure the auxiliary air gauge builds up to the 140 psi range.

   l. Push the hydraulic pump start button and the hydraulic pumps should start.

   m. Check the hydraulic pressure gauge and ensure that the pressure builds up to from 200 to 500 psi.

   n. Check the load on the bit gauge. The pressure should build up to from 150 to 250 pounds.

   o. Push the hoist/propel and rotary control start button so that all of the circuits are activated to the motors for hoist/propel and rotary.

      Should either the hydraulic pressure gauge or the load on the bit gauge fail to come up to the specified pressure, shut the drill down immediately and report the problem to the supervisor.

2. **Shut down**

   Follow these procedures to shut the drill down:

   a. Ensure that the drill is stable.

   b. Make sure that the drill pipes are up and stored.

   c. Make sure that all of the controls are in neutral or in the off position.

   d. Push the hoist/propel and rotary control stop button so that all of the circuits to the motors for the hoist/propel and rotary are deactivated.

   e. Push the hydraulic pump stop button to shut down the hydraulic pumps.

f. Push the main air compressor stop button to shut down the main air compressor.

g. Place the control air on/off control to the off position to shut down the control air.

h. Place the pressurized water injection control to the off position to shut off the water.

i. Lower the drill onto the tracks and off of the jacks if it is to be left for any length of time.

j. Push the MG set stop button to shut down the motor generator.

OBJECTIVE 4-5

The drill operator will perform operational checks on the drill, checking the propelling, steering, stopping and hydraulic control responses.

KEYPOINTS/PROCEDURES

1. **Propel**

   To check propel on the drill, the operator must:

   a. Ensure that all personnel and equipment are clear of the path the drill is to travel.

   b. Place the propel position/electric hoist/drilling position control to the propel position.

   c. Place the propel clutch control to the desired propel position.

   d. Place the hoist/propel speed control to the desired direction and speed.

2. **Steering**

   To check the steering on the drill, the operator must follow the procedures for propel. To steer, move the propel clutch control to the desired position. To turn left, place the propel clutch in the left hand propel clutch position. To turn right, place it in the right hand propel clutch position. These procedures assume that the operator is facing towards the front idlers.

3. **Stopping**

   To check the stopping abilities of the drill while propelling, the operator must:

   a. Place the hoist/propel speed control to the off position.

   b. Place the propel clutch control into the neutral position.

   c. Push the hoist/propel and rotary stop button to deactivate the circuits to the hoist/propel and rotary motors.

4. **Hydraulic controls**

   The drill operator must check all of the hydraulic controls for response.

5. Report any problems to the supervisor.

OBJECTIVE 4-6

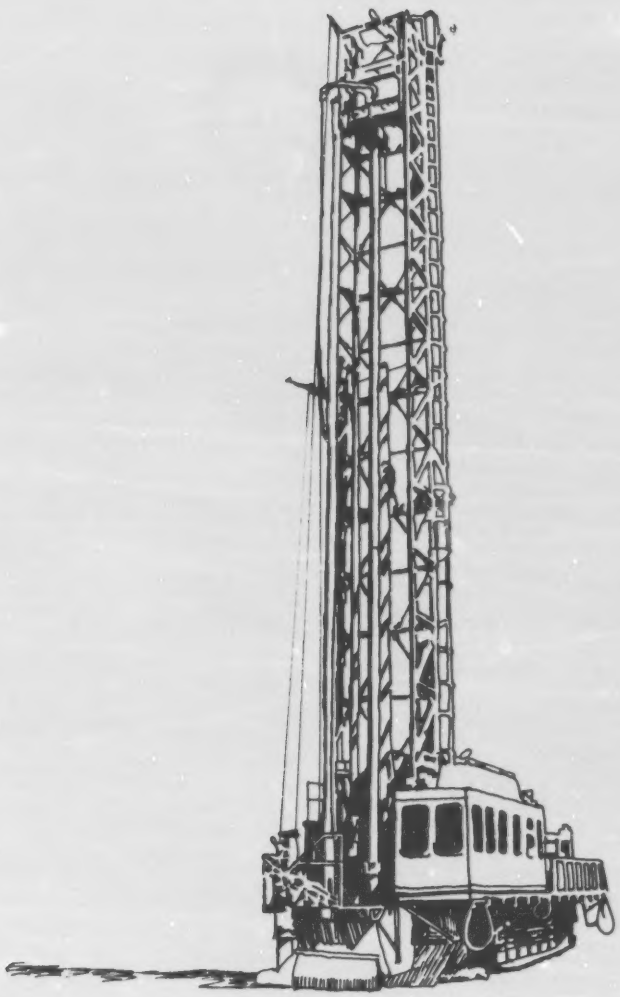
The drill operator will describe the proper procedures for a cold weather start of the drill.

KEYPOINTS/PROCEDURES

1. Start up procedures are given in OBJECTIVE 4-4.
2. Follow these procedures for cold weather starting:
   a. If the power has been off on the drill everything is going to be cold. Turn all of the machinery house heaters on, to warm up the hydraulic tank, lines and the hydraulic fluid.
   b. Once the water tank has been filled turn the water heater on.
   c. Once the machine house and the hydraulic oil have warmed up, turn on the hydraulic pump. If there is a noise from the pump it is the pump cavitating because of cold hydraulic oil. Run the pump for short periods of time then shut it down. Continue this procedure until the hydraulic oil warms up and the pump stops cavitating.

BASIC OPERATION

module 5



OBJECTIVE 5-1

The drill operator will demonstrate proper propelling techniques.

KEYPOINTS/PROCEDURES

1. **Forward motion**

   Follow these procedures for forward motion:

   a. Ensure that all personnel and equipment are clear of the route that the drill is to travel.

   b. Push the hoist/propel and rotary control start button.

   c. Place the propel position/electric hoist/drilling position control to the propel position.

   d. Place the propel clutch control to the desired position.

   e. Place the hoist/propel speed control into the forward position at the desired speed.

2. **Reverse motion**

   Follow the same procedures as for forward motion except place the hoist/propel speed control into the reverse position.

3. While propelling the drill, always watch for overhead power lines. Do not exceed a 15 percent grade while travelling with the mast raised.

OBJECTIVE 5-2

The drill operator will demonstrate proper steering techniques.

KEYPOINTS/PROCEDURES

1. **Steering**

   Follow these procedures for steering the drill:

   a. Follow the procedures for propelling the drill as given in OBJECTIVE 5-1.

   b. To steer, place the propel clutch into the left hand clutch position for left turns and into the right hand clutch position for right turns.

   c. Make all turns in gradual increments of 15 to 20 degrees at a time. Tight turns put excessive strain on the tracks and propel machinery.

   d. To free tracks of the build-up of material, use the reverse motion.

      The steering direction given presumes that the operator is facing forward.

OBJECTIVE 5-3

The drill operator will demonstrate proper levelling techniques.

KEYPOINTS/PROCEDURES

1. **Level drill**

   Follow these levelling procedures:

   a. Ensure that the hydraulic pump is running.

   b. Place both the left hand and right hand jack controls to the raise position, until the jack pads hit the ground and begin to raise the low end of the drill.

   c. Place both the left hand and right hand controls into the neutral position.

   d. Place the front jack controls to the raise position until the jack pads make contact with the ground and start raising the machinery.

   e. Place the front jack controls back into the neutral position.

   f. Look at the levelling gauge (there are two in the cab). One is located on the left wall and the other on the rear wall. For the final adjustments, move the controls so that the rear end, the side of the machine and the ends of the drill are level. This is accomplished by using a combination of the left hand, right hand and front jack controls.

2. The drill should be kept as low as possible on the jacks but level with the weight off of the crawler frames. The tracks should always stay in contact with the ground with the weight of the machine off of the rollers.

OBJECTIVE 5-4

The drill operator will demonstrate the proper techniques for raising the drill mast.

KEYPOINTS/PROCEDURES

1. **Raise the mast**

   Follow these procedures for raising the mast:

   a. Make sure that the drill is stable.

   b. Check the mast hinge pins and keepers to make sure that they are secure.

   c. Check to make sure that the mast will not touch any overhead power lines, once it is fully raised.

   d. Ensure that the rotary head is at the bottom of the mast.

   e. Check the drill pipe and racks to make sure that they are secure.

   f. Check the deck area for any personnel before raising the mast.

   g. Make sure the mast anchor pins are fully retracted.

   h. Push the hydraulic pump start button and start the hydraulic pump.

   i. Place the mast down/up control into the up position.

   j. Watch the hydraulic gauge for fluctuations in pressure. There can be air in the hydraulic lines which requires bleeding.

   k. Slowly the mast should approach the vertical position.

   l. Once the mast is vertical check to ensure that it is seated properly.

   m. Place the mast down/up control into the neutral position.

   n. Push the mast anchor pin control so that the anchor pins move to the seated position. Visually check that the pins are in the correct position.

   o. Place the mast anchor pin control into the neutral position.

   p. Place the mast back braces control into the lock position and hold until the braces lock and the sleeves are in position. Visually check to ensure that the back lock sleeves are in position.

   q. Place the mast back braces control into the neutral position.

OBJECTIVE 5-5

The drill operator will demonstrate the proper techniques for operating the tool wrench.

KEYPOINTS/PROCEDURES

1. **Operate the tool wrench**

   Follow these procedures for operating the tool wrench:

   a. Line up the drill pipe break out slots with the tool wrench. Make sure that the rotation is stopped. If the break out slots are badly worn it may be necessary to have lugs welded on.

   b. Turn on the shut off valves that control the air to the tool wrench. The valves are mounted on the back panel below the console.

   c. Put the tool wrench control into the centered position until it is around the pipe break out slots. Then put the control into neutral.

   d. Make sure visually that the tool wrench is seated in the breakout slots properly.

   e. Once the next joint has been completed place the tool wrench control into the retract position. Hold it there until the tool wrench is fully retracted. Then place the control into neutral.

   f. If the tool wrench is not to be used turn off the shut off valves.

OBJECTIVE 5-6

The drill operator will demonstrate the proper procedures for operating the casing tongs.

KEYPOINTS/PROCEDURES

1. **Operate the casing tongs**

   Follow these procedures for operating the casing tongs:

   a. Ensure that the pipe rotation is stopped.

   b. Hook the winch line to the casing tongs.

   c. Put the auxiliary winch control into the raised position and lift the casing tongs high enough to be positioned above the pipe joint.

   d. Put the winch controls into neutral and cautiously latch the tongs around the drill pipe by hand.

   e. Make sure that the tong cylinder rod is fully retracted before pinning the casing tongs to the cylinder rod eye.

   f. Place the casing tong control to the extended position. As it is being extended the tongs should grip the pipe and uncouple the joint. The operator has to repeat the procedure until the joint is broken. Once the joint is broken put the casing tongs control into neutral.

   g. Using the auxiliary winch, unpin and move the casing tongs away from the area.

   h. Put the casing tongs control into retract and when the cylinder is fully retracted put the control into neutral.

   i. Take the tongs off of the pipe and store them away using the winch.

OBJECTIVE 5-7

The drill operator will demonstrate the proper procedures for uncoupling drill pipe.

KEYPOINTS/PROCEDURES

1. **Uncouple pipe**

   Follow these procedures for uncoupling pipe:

   a. Check to ensure that the bailing air is off.

   b. Make sure that the water injection controls are off and that the water system is blow down.

   c. Put the pull down and rotary controls into neutral.

   d. Push the hoist/propel and rotary start button to start the hoist/propel and rotary motors.

   e. Put the rotary speed control into forward and position it for slow rotation.

   f. Place the propel position/electric hoist/drilling position control into the electric hoist position.

   g. Put the hoist/pulldown clutch control into engage.

   h. Put the hoist/propel speed control into hoist and raise the pipe until the joint is completely above the deck bushing. Line up the break out slots of the joint with the tool wrench.

   i. Place both the rotary speed control and the hoist/propel speed control into the off positions.

   j. Using the tool wrench control move the control into the extend position and engage the tool wrench into the slots in the pipe. Also, check to ensure that the tool wrench is seated properly.

   k. Place the rotary speed control into forward at a very slow rotation. Rotate the pipe until the tool wrench dogs click. Go a quarter turn past the click and then place the rotary speed control into the off position.

   l. Put the rotary speed slection control into low speed and high torque position.

   m. Put the rotary speed control into reverse and rotate as required to break the pipe joint. Once the joint has been broken put the rotary speed control into the off position.

   n. Follow the procedures for either racking the pipe (Objective 5-14) or adding pipe from the pipe rack (Objective 5-13).

2. The drill operator must be aware that the drill string uncouples at another joint or at the rotary head.

OBJECTIVE 5-8

The drill operator will demonstrate the proper techniques for raising the rotary head.

KEYPOINTS/PROCEDURES

1. **Raise the rotary head**

   Follow these procedures for raising the rotary head:

   a. Push the hoist/propel and rotary control start button to activate the motor circuits.

   b. Place the propel position/electric hoist/drilling position control into the electric hoist position.

   c. Place the hoist pull down clutch control into the engage position.

   d. Place the hoist/propel speed control into hoist position as it is needed, then return the control back to the off position slowly.

   e. Place the hoist/pull down clutch control into the brake position.

   f. When the operator is not going to continue without a delay, push the hoist/propel and rotary control stop button to deactivate the motor circuits.

OBJECTIVE 5-9

The drill operator will demonstrate the procedures for attaching the stabilizer.

KEYPOINTS/PROCEDURES

1. **Attach the stabilizer**

   Follow these procedures for attaching the stabilizer to the drill pipe:

   a. Make sure that the threads and shoulders of the drill pipe and the stabilizer are lubricated.

   b. Clear the deck by hoisting the drill steel. This is accomplished by pushing the hoist/propel and rotary control start button to activate the motor circuits. Then place the propel position/electric hoist/drilling position control to the electric hoist position. Place the hoist/pull down clutch control to the engage position. Place the hoist/propel speed control to the hoist position as required and then place the control into off. Position the hoist pull down clutch control into the brake position.

   c. Put the stabilizer in the tool wrench by using the auxiliary winch and hoisting bail.

   d. Line up the stabilizer with the tool wrench by using the auxiliary winch control which raises or lowers the hook as needed.

   e. Place the tool wrench control to the extended position so that the tool wrench is engaged. Check to ensure that the tool wrench is seated properly in the stabilizer recesses.

   f. Once in place, take off the hoisting bail and the winch line and store them out of the way.

   g. Install the deck bushing on top of the stabilizer.

   h. Place the hoist/pull down clutch control into the engage position.

   i. Place the rotary speed control into the forward position and then slowly move the hoist/propel speed control to the lower position as needed to make the joint (drill pipe to stabilizer). Check to make sure that the joint is made properly.

   j. Once the joint has been completed place both the rotary speed control and the hoist/propel speed control to the off positions.

   k. Place the tool wrench control into the retract position. Once the tool wrench has been retracted put the control into neutral.

   l. Place the hoist/propel speed control into the hoist position as needed and then turn the control off.

   m. Place the hoist/pull down clutch control into the brake position.

   n. Push the hoist/propel and rotary control stop button to stop the motor.

2. Check the wear on the deck bushing. If the bushing has excessive wear have it replaced.

OBJECTIVE 5-10

The drill operator will demonstrate the procedures for attaching the drill bit to the stabilizer.

KEYPOINTS/PROCEDURES

1. **Attach the drill bit**

   Follow these procedures for attaching the drill bit to the stabilizer:

   a. Hoist up the drill pipe and stabilizer to clear the deck of the drill using the same procedures as given in OBJECTIVE 5-9.

   b. Using the auxiliary winch to handle the bit break out wrench, and install the wrench in the platform. Use the auxiliary winch control to raise or lower the hook as required to line-up the bit break out wrench with the platform locking lugs.

   c. Using the hoisting bail and auxiliary winch, position the bit into the break out wrench. Ensure that the bit is properly seated into the break out wrench.

   d. Check the threads on the stabilizer and bit and lubricate properly.

   e. Place the hoist pull down clutch control into the engaged position.

   f. Place the rotary speed control into the forward position slowly. Then move the hoist/propel speed control to the lower position slowly as is required to make the joint between the stabilizer and the bit. Check the joint to ensure a proper connection has been made.

   g. Release the bit from the breakout wrench.

   h. Once the connection has been made, place the rotary speed control and the hoist/propel speed control into the off position.

   i. Hoist up the bit from the break out wrench by placing the hoist/propel speed control into hoist. Once it has cleared the wrench put it into the off position.

   j. Place the hoist/pull down clutch control into the brake position.

   k. Push the hoist/propel and rotary control stop button to stop the motor.

   l. Using the auxiliary winch, remove the bit break out wrench from the platform. Manipulate the winch control to raise or lower the hook as required, to remove and store the bit break out wrench and winch line.

OBJECTIVE 5-11

The drill operator will demonstrate the proper techniques for preparing to drill and collaring the hole.

KEYPOINTS/PROCEDURES

1. **Prepare to drill**

   Follow these procedures for preparing to drill the hole:

   a. Ensure that the drill is set and levelled.

   b. Make sure that all of the propel controls are in the neutral position.

   c. Make sure that the main air compressor is running.

   d. Ensure that the main air control is in the off position.

   e. Check the drill pipe stabilizer and bits for proper connections and condition.

   f. Push the hoist/propel and rotary control start button to start the motor.

   g. Place the propel position/electric hoist/drilling position control to the electric hoist position.

   h. Put the hoist/pull down clutch control to the engage position.

   i. Place the hoist/propel speed control slowly into the lower position.

   j. Put the hoist/propel speed control into the off position.

   k. Place the hoist/pull down clutch control into the brake or hold position.

   l. Make sure the deck or drill pipe guide bushing is properly seated in the deck.

   Different ground conditions need different collar depths. Soft material requires a deeper collar.

2. **Collar the hole**

   Follow these procedures to collar the hole:

   a. Clear all personnel off the drilling deck during drilling.

   b. Reset the depth counter to zero.

   c. Place the main air control to the on position and check to ensure that the bailing air is blowing down and through the drill pipe. Lower the drill pipe until the bit is at the ground level.

   d. Put the water injection control to the inject position so that the water can be started into the water injection system.

   e. Make an adjustment to the water valve control for the desired amount of flow. The flow can be checked with the water sightglass.

   f. Make sure that the air pressure on the main air pressure gauge is at the proper psi according to the size of drill bit orifice.

   g. Check the bit air pressure. The gauge should read between 2 to 3 pounds.

   h. Put the rotary speed selector control into low speed and high torque.

   i. Slowly move the rotary speed control forward to the collaring speed. The speed is determined by the drilling conditions. Watch the steel at the deck bushings for any signs of whipping and adjust the speed accordingly.

   j. Place the automatic pull down control into the manual position.

k. Place the propel position/electric hoist/drilling position control into the drilling position.

l. Place the pull down selector switch into the down position.

m. Put the hoist/pull down clutch control into the braking position.

n. Slowly put the pull down increase/decrease control towards the increase position and continue until the collar depth is reached.

o. Adjustments to the load on the pull down must constantly be made, depending on the drilling conditions, to prevent the rotary motor from operating in a stall current situation.

p. Check the rotary motor load current amp gauge. Keep the gauge position in the green and not in the red.

All new bits need a break in period as specified by the company.

OBJECTIVE 5-12

The drill operator will demonstrate proper drilling techniques.

KEYPOINTS/PROCEDURES

1. **Drill the hole**

   Follow these procedures for drilling the hole:

   a. Make sure that there are no personnel on the drill deck during drilling.

   b. Slowly move the rotary speed control in the forward direction to the desired speed.

   c. Continually monitor the rotary speed by watching the rotary motor forward speed rpm gauge.

   d. As the drilling conditions change, adjust the rotary speed control.

   e. Adjust the pull down increase/decrease control towards the increase position to the desired bit loading. Keep monitoring the load on the bit gauge.

   f. Make adjustments with the pull down increase/decrease control. The adjustments are dictated by the drilling conditions.

   g. Make adjustments to the water valve control as required to maintain dust control.

   h. Watch the water sightglass to determine the amount of water being injected into the system. This is important because too much water can lead to shorter bit life.

   i. During the drilling operation watch the:

      - Rotary motor forward speed rpm gauge.
      - Rotary motor load current amp gauge. Keep the gauge in the green (125 to 150 amps average).
      - Load on bit gauge. The inside reading is about 1100 to 1400 psi depending on the bit and drilling conditions. The outer reading is a number that is not related to psi. In soft drilling it averages 70 on the gauge. In hard drilling, back off on the load or down pressure until the drill runs smoothly.
      - Bit air pressure gauge. Monitor the bit air pressure gauge.
      - Depth counter. The depth counter gives the operator the approximate footage of the hole drilled.
      - Drilling is naturally dictated by the drill conditions. No specific readings are correct for production drilling — there are many combinations. For hard drilling use less rotation with more down pressure; for soft drilling use more rotation with less down pressure. Adjustments are constantly being made so that the drill runs smoothly and is not abused. Drilling conditions dictate the proper gauge readings for the different conditions.

   j. Keep drilling until the depth of the hole has been reached or until the pipe break out slots are down past the tool wrench.

   k. Raise the drill pipe keeping the rotation and air operating.

   l. Place the pull down selector switch into the neutral position.

   m. Place the water injection control into the off position.

n. Put the hoist/pull down clutch control into the braking position.

o. Place the propel position/electric hoist/drilling position control into the hoist position.

p. Put the hoist/pull down clutch control into engage.

q. Place the hoist/propel speed control into hoist as required, and then turn it off.

r. Put the propel position/electric hoist/drilling position control into the hoist position.

s. Place the main air control into off position. Blow down the system before turning it off.

t. Pressing the hoist/propel and rotary control stop button, stop the motors.

OBJECTIVE 5-13

The drill operator will demonstrate the proper procedures for adding drill pipe from the pipe rack.

KEYPOINTS/PROCEDURES

1. **Add drill pipe**

   Follow these procedures for adding drill pipe:

   a. Ensure that the bailing air is off.

   b. Make sure that the hole is drilled down so that the tool wrench can be engaged into the drill pipe slots.

   c. Place the controls for the pull down and rotary into the neutral or off position.

   d. Push the hoist/propel and rotary control start button.

   e. Place the propel position/electric hoist/drilling position control into the hoist position.

   f. Put the hoist/pull down clutch control into the engage position.

   g. Place the hoist/propel speed control into the hoist position as required to align the drill pipe recesses with the tool wrench. Then place the control into the off position.

   h. Using the tool wrench control engage the tool wrench with the recess in the pipe. Check to ensure that the wrench is well seated into the recesses.

   i. Put the rotary speed selection control into the low speed/high torque position. Then move the rotary speed control into reverse to break the pipe from the rotary head. Do not let the rotary motor stall and cause damage. If the pipe joint does not break use the casing tongs. The drill operator must be aware that the drill string uncouples at another joint, e.g., at the rotary head. Leave the rotary speed control in reverse until the joint has separated. Then place the rotary speed control into the off position. Never let the unscrewing threads force the rotary head upwards.

   j. Place the hoist/propel speed control into hoist. Separate the joint and hoist the rotary head up so that it clears the pipe rack. Turn off the hoist/propel speed control.

   k. Put the hoist/pull down clutch control into the braking position.

   l. Push the left hand pipe rack latch control and unlock the pipe rack. Then release the control.

   m. Put the left hand pipe rack control into the lower position. Hold it until the rack comes down and forward, and the pipe is in position below the rotary head. Place the control into neutral.

   n. Place the rotary speed control slowly into the forward position for slow rotation.

   o. Place the hoist/pull down clutch control into the engage position.

   p. Place the hoist/propel speed control slowly into the lower position. The rotary head joins up with the pipe and the joint is made between the rotary head and the pipe.

q. Put the hoist/propel speed control into the hoist position and hoist it up until the pipe has cleared the pipe rack. Then, put the hoist/propel speed control into the off position.

r. When making these joints made sure that all threads are clean and well lubricated.

s. Place the left hand pipe rack control into the up position and hold it until the pipe rack is retracted back into the storage position. Then, place the control into neutral, making sure that the green light is on, indicating that the rack is locked.

t. Place the hoist/propel speed control slowly into the lower position. Line up the box of the top pipe with the pin on the pipe being held by the tool wrench.

u. Place the hoist/propel speed control into the off position.

v. Put the rotary speed control slowly into forward for slow rotation at approximately twenty to thirty rpm. The top pipe joins up with the bottom pipe, which is held by the tool wrench. Once the joint is started, set the hoist/pull down clutch control into the brake position. After the joint is completely made put the rotary speed control to off.

w. Retract the tool wrench once the joint is made.

x. Lower the bit to the bottom of the hole and continue drilling.

OBJECTIVE 5-14

The drill operator will demonstrate the proper procedures for racking drill pipe.

KEYPOINTS/PROCEDURES

1. **Rack pipe**

   Follow these procedures for racking drill pipe:

   a. Make sure that the rotary head is at the top of the mast and clears the pipe racks.

   b. Make sure that the lower pipe is held by the tool wrench.

   c. Disconnect the upper pipe from the lower pipe.

   d. Put the hoist/pull down clutch control into the brake position.

   e. Push the left hand pipe latch control and hold it until the pipe rack moves out of the locked position.

   f. Put the left hand pipe rack control into the down position and hold it until the pipe rack is down and forward. It must be positioned under the upper drill pipe and seated onto the pin end of the lower drill pipe, which is being held by the tool wrench.

   g. Put the hoist/pull down clutch control into the engage position.

   h. Slowly put the hoist/propel speed control into the lower position. Lower the upper pipe so that it fits over the guide pin and is seated properly in the pipe rack. Shut off the hoist/propel speed control.

   i. Check the pipe rack to ensure that the pipe is seated and secure in the pipe rack.

   j. Put the rotary speed control slowly into forward for a slow rotation. Rotate the pipe slowly until the pipe wrench dogs click. Once they have clicked rotate an extra one quarter turn past the click and put the control into the off position.

   k. Put the rotary speed selection control into low speed and high torque.

   l. Place the rotary speed control into reverse and as required rotate it until the break between the rotary head and the pipe has been made. Once the joint separates put the rotary speed control into the off position.

   m. Put the hoist/propel speed control into hoist until the rotary head clears the top of the pipe rack. Then turn the control off.

   n. Put the hoist/pull down clutch control into the brake position.

   o. Push the left hand pipe rack control into the up position and hold it until the pipe rack starts up and is back into the storage position. Put the control back into neutral once each is locked into place and the secure light is on.

   p. Put the hoist/pull down clutch control to engage and place the hoist/propel speed control into the lower position. Lower the rotary head until it lines up with pipe being held by the tool wrench.

   q. Put the hoist/pull down clutch control into the braking position.

   r. Put the hoist/propel speed control to the off position and slowly put the rotary speed control into forward for slow rotation. The rotary head should join up with the pipe being held by the tool wrench. Once the joint has been made turn off the rotary speed control.

s. Before retracting the tool wrench ensure that a proper joint has been made. Put the tool wrench control into retract and hold it until the tool wrench is fully retracted. Then place the control into neutral.

t. Continue pulling the second pipe out of the hole and repeat the procedures if necessary.

68. *Objective 5-14*

OBJECTIVE 5-15

The drill operator will demonstrate the proper procedures for retracting the levelling jacks.

KEYPOINTS/PROCEDURES

1. **Retract the levelling jacks**

   Follow these procedures for retracting the levelling jacks:

   a. Push the dust curtain control to the up position and hold it until the curtains are fully raised.

   b. Make sure that the front ladder is in the up position.

   c. Push the left hand jack control, the front jack control and the right hand jack control to the lower position until the three jacks are fully retracted. Once fully retracted put the controls into neutral.

      On the controls, raise and lower refers to the raising and lowering of the drill. On ground that is not level, lower the corner that is the highest first. Always lower the drill slowly and evenly until the tracks make contact with the ground.

OBJECTIVE 5-16

The drill operator will demonstrate the procedures for removing the drill bit.

KEYPOINTS/PROCEDURES

1. **Hoist the bit**

   Follow these procedures to hoist the bit to clear the platform:

   a. Push the hoist/propel and rotary control start button to start the motors.

   b. Put the propel position/electric hoist/drill position control into the electric hoist position.

   c. Place the hoist pull down clutch control into engage.

   d. Put the hoist/propel speed control into hoist as required. Then turn the control off slowly.

   e. Put the hoist pull down clutch control into the braking position.

   f. Push the hoist/propel and rotary control stop button and shut down the motor circuits.

2. Operate the auxiliary winch control to either raise or lower the hook as required, to install the bit break out wrench into the drill platform. Make sure that the bit break out wrench lines up properly with the drill platform locking lugs. The drill operator must be aware that the drill string uncouples at another joint, e.g., at the rotary head.

3. **Lower the bit**

   Follow these procedures to lower the bit into break out wrench:

   a. Start the motor circuits by pushing the hoist/propel and rotary control start button.

   b. Put the propel position/electric hoist/drilling position control into the electric hoist position.

   c. Place the hoist/pull down clutch control into engage. Line up the bit with the break out wrench. Then turn the control off.

   d. Slowly put the hoist/propel speed control into the lower position as is needed, to lower the bit into the wrench. Once the bit is in the wrench shut off the control.

   e. Put the hoist pull down clutch control into the braking position. Check the break out wrench and the bit to ensure that they are properly seated.

   Caution:

   If using a bit pot rather than a bit wrench, use extreme caution as too much pressure can damage the bit.

4. **Separate the bit**

   To separate the bit from the stabilizer rotate the drill pipe and hoist as follows:

   a. Start the motor circuits by pushing the hoist/propel and rotary control start button.

   b. Put the propel position/electric hoist/drilling position control into hoist.

c. Place the hoist/pull down clutch control into the engage position.

d. Slowly turn the rotary speed control into the reverse position.

e. Put the hoist/propel speed control into the hoist position. As the joint is being separated hoist up as needed to keep the bit off the bottom of the breakout wrench. Once the separation has been made put the control into the off position.

f. Put the hoist/pull down clutch control into the braking position.

g. Stop the motor circuits by pushing the hoist/propel and rotary stop button.

h. Using the auxiliary winch control to control the raising and lowering of the winch line, attach the lifting box to the bit, hook the wrench line to the bail and then raise the bit out of the break out wrench. Put the used bit to the side and replace it.

OBJECTIVE 5-17

The drill operator will demonstrate the procedures for removing the stabilizer from the drill pipe.

KEYPOINTS/PROCEDURES

1. **Remove the stabilizer**

   Follow these procedures for removing the stabilizer from the drill pipe:

   a. Make sure that the bail air is shut off.

   b. Remove the drill bit from the stabilizer (Objective 5-15).

   c. Start the motor circuits by pusing the hoist/propel and rotary control start button.

   d. Put the propel position/electric hoist/drilling position control into the electric hoist position.

   e. Place the hoist/pull down clutch control into the engage position.

   f. Put the hoist/propel speed control into the hoist or lower position as required, to line up the recess at the top of stabilizer with the tool wrench. Then turn the control to the off position.

   g. Put the hoist/pull down clutch control into the brake position.

   h. Pull the tool wrench control to the extend position, and check to ensure that the tool wrench is seated properly in the recess at the top of the stabilizer. Then put the tool wrench control into neutral.

   i. Break the joint between the stabilizer and the pipe by putting the rotary speed selection control into low speed and high torque. Turn the rotary speed control into reverse as required to make the break. Check to ensure that the break is made between the stabilizer and the drill pipe.. The drill operator must be aware that the drill string uncouples at another joint, e.g., at the rotary head.

2. To separate the joint between the stabilizer and the drill pipe rotate the drill pipe and hoist by following these procedures:

   a. Start the motors by pushing the hoist/propel and rotary start button.

   b. Put the propel position/electric hoist/drilling position control into the electric hoist position.

   c. Put the hoist/pull down clutch control into the engage position.

   d. Slowly put the rotary speed control into the reverse position.

   e. Put the hoist/propel speed control into hoist as the joint between the stabilizer and the drill pipe is separating. Once the separation is made shut off both the rotary speed control and the hoist/propel speed control.

   f. Put the hoist/pull down clutch control into the brake position.

   g. Stop the motors by pressing the hoist/propel and rotary stop button.

3. Using the lifting bail and auxiliary winch remove the stabilizer and store it out of the way.

OBJECTIVE 5-18

The drill operator will demonstrate the procedures for retracting the mast anchor pins and the back braces.

KEYPOINTS/PROCEDURES

1. **Retract the mast anchor pins and the back braces**

   Follow these procedures for retracting the mast anchor pins and the back braces:

   a. Make sure that the drill has been levelled.

   b. Open the roof doors that are over the mast cylinders.

   c. Pull the mast anchor pins control to the decrease position and hold it until the mast anchor pins are fully retracted.

   d. Pull the mast back brace control into the unlock position and hold it until the track lock sleeves are fully retracted. Check to ensure that the brace lock sleeves are fully retracted.

   e. Put the mast back braces control into the neutral position.

OBJECTIVE 5-19

The drill operator will demonstrate the proper procedures for lowering the mast.

KEYPOINTS/PROCEDURES

1. **Lower the mast**

   Follow these procedures for lowering the mast:

   a. Make sure that the drill is level and stable.

   b. Check that the mast hinge pins and keeper are in place.

   c. Check the hydraulic system for leaks before lowering the mast.

   d. Make sure the rotary head is at the bottom of the mast.

   e. Check the pipe and racks to ensure that they are secure and stored out of the way.

   f. Check the deck area for people or loose equipment.

   g. Press the hydraulic pump start button and start the hydraulic system.

   h. Push the mast down/up control to the down position and then pull it back fully into the up position. Do this several times to bleed the hydraulic lines of air in the system. Air in the lines can cause the mast to whip while being lowered.

   i. Retract the mast anchor pins and mast back braces as described in OBJECTIVE 5-18.

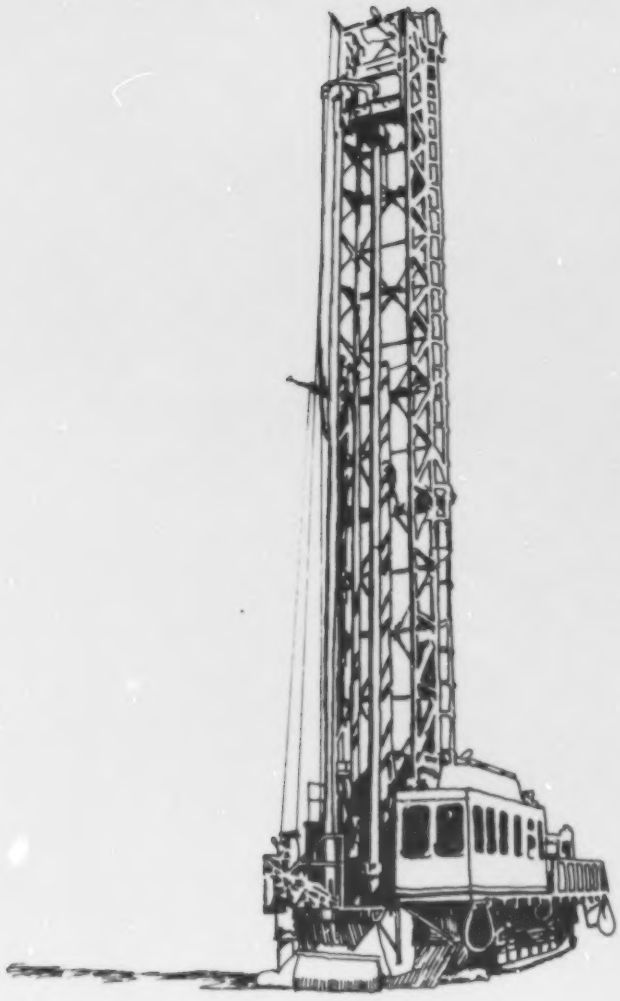
   j. Push the mast down/up control into the down position and hold it as the mast is coming to the bottom. Slow the speed up by slowly releasing the control.

   k. Check to ensure that the mast is properly seated once it is completely down.

   l. Put the mast down/up control into the neutral position.

SERVICE THE DRILL

module 6



OBJECTIVE 6-1

The drill operator will demonstrate the practices of good housekeeping on the drill.

KEYPOINTS/PROCEDURES

1. The drill operator should follow these procedures to keep the operator's cab and the machinery room clean:
   - Pick up and dispose of all oily rags and paper.
   - Clean up oil spills in the machinery room or on the drill platform to eliminate any hazards that can cause a fall.
   - Clean all of the windows on the drill.
   - Keep all handrails and ladders clean and eliminate anything that can cause a fall.
   - Do not store any aerosol cans in the cab area because of the danger of them exploding. Keep them in a cool place in the machinery room.
   - Keep the drill platform clean of mud, ice and snow build-up. Ensure proper walking safety.
   - Keep everything stored out of the way on the drill platform so that it is not a tripping hazard.
   - Be sure that no material is stored in the high voltage room.
   - Make sure that all walkways are clear of obstructions.

OBJECTIVE 6-2

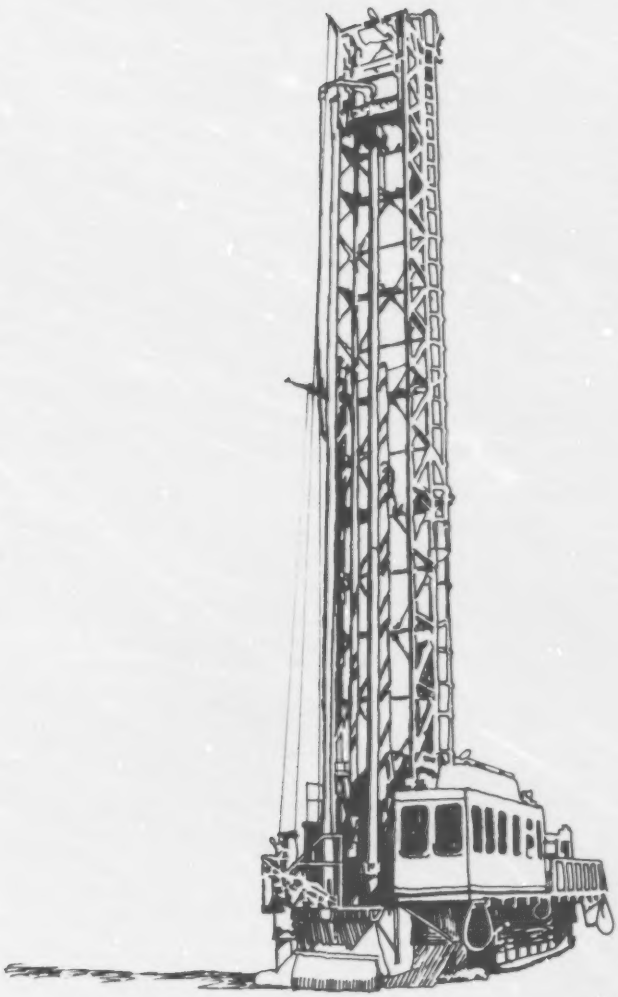
The drill operator will demonstrate the proper lubrication procedures.

KEYPOINTS/PROCEDURES

1. The drill operator should check the lubricant and fluid levels. Add the lubricants or fluids as required, using the lubrication guide as a reference for the:
   - Rotary gear case lubricant.
   - Hydraulic fluid.
   - Compressor fluid.
   - Auxiliary compressor lubrication.
   - Water tank.
2. The operator should become familiar with all of the lubrication points, that are to be greased manually on the drill. Clean the grease fittings before and after the servicing. It is recommended that grease fittings on electrical motors be greased by an electrician.
3. The drill operator should be familiar with the automatic lubrication system by:
   - Knowing the operation of the system.
   - Knowing the lubrication points.
   - Keeping the lubrication levels full.
   - Keeping the lubricant free of any dirt or impurities.
   - Knowing the readings of the indicators.

MOVE THE DRILL

module 7



OBJECTIVE 7-1

The drill operator will explain how to assist the foreman to plan a move.

KEYPOINTS/PROCEDURES

1. The drill operator, when planning a move, should discuss with the supervisor the:
   - Route and distance to be travelled. Plan for overhead power lines and road grades.
   - Preparation of the route.
   - Preparation of the drill for the move.

OBJECTIVE 7-2

The drill operator will explain what to look for when checking the conditions of the road that the drill is to travel on.

KEYPOINTS/PROCEDURES

1. The drill operator should follow these procedures:
   - Check the width of the road. The road must be wide enough for the drill to travel safely.
   - Check the grade of the road. Ensure that the drill is not going to travel up a grade that is too steep. With the mast up do not travel on a grade in excess of 15 percent.
   - In winter the drill operator may have to bring in crushed rock to cover ice and packed snow that cause slippery travelling conditions for the drill.
   - Use a track dozer as a back up in case of a drill run away.

OBJECTIVE 7-3

The drill operator will demonstrate the proper procedures for preparing the drill for a move.

KEYPOINTS/PROCEDURES

1. Follow these procedures to prepare the drill for a move:
   a. Lower the mast.
   b. Have the power cable prepared for adding or taking cable off in all situations.
   c. Check the road conditions and make preparations to the road if necessary.
   d. Ensure that all track parts are greased and check the propel gears for lubrication.
   e. Have all communications and signals to ground personnel completely understood.

OBJECTIVE 7-4

The drill operator will demonstrate the proper procedures for preparing the drill to be towed.

KEYPOINTS/PROCEDURES

1. Follow these procedures for preparing the drill for towing:
   a. Make sure that the mast is down.
   b. Be sure that all of the controls are in neutral or in the off position.
   c. Make sure that the power cable is disconnected and stored out of the way.
   d. Prepare the drill for towing by attaching the tow bar. Attach the tow bar to the piece of equipment doing the towing, which in most cases is the track dozer.
   e. Attach all of the safety lines.
   f. A portable air compressor is needed to supply air to release the spring loaded air brakes. Hook up the compressor to the system.
   g. Put the propel clutch control into the neutral position.
   h. Engage the brake release system valve. The valve is located in the house on the rear right wall.
   i. Put the propel position/electric hoist/drilling position control into the propel position.
   j. Put the propel clutch control into the desired position for steering the drill while it is being towed. Remember that the propel position/electric hoist/drilling position control must be in propel at the same time that the propel clutch control is in the desired steering position. If it is not the brakes come on.
   k. Tow the drill slowly and carefully. Use extreme caution at all times.
   l. The drill operator must be in the cab near the controls when being towed, in case of an emergency.

OBJECTIVE 7-5

The drill operator will demonstrate the proper procedures for moving the drill on a ramp.

KEYPOINTS/PROCEDURES

1. Follow these procedures for moving a drill on a ramp:
   a. Make sure that the drill pipe is racked.
   b. Remove the stabilizer and bit and store them out of the way.
   c. Lower the rotary gear box to the bottom.
   d. Check the propel chains and propel brakes before moving down or up the ramp.
   e. Propel slowly and avoid a jerking motion.
   f. When propelling up the ramp, have the rear of the drill go up first.
   g. When propelling down the ramp, have the front of the drill go down first.
2. **Stability limits**

   When the mast is up and the front end is high, the grade should not be over 20 percent. With the mast down the grade should not be over 30 percent.

SPECIAL ASSIGNMENTS

module 8

OBJECTIVE 8-1

The drill operator will describe the fishing techniques used on drills.

KEYPOINTS/PROCEDURES

1. **Drill pipe down a hole**

   There is no standard method for fishing out drill pipe. These procedures are only an example. The drill operator will develop techniques through experience. If the drill pipe is disconnected and a pipe has fallen to the bottom of the drill hole follow these procedures:

   a. Run the open pipe down the hole to see if it is clear.

   b. If it is clear, make a connection by rotating the box end of the pipe into the pin end of the pipe that has dropped into the hole.

   c. Use air once the connection is made to blow any material out of the hole as the pipe is being hoisted up.

2. Should the drill operator find that material has fallen on top of the pipe and is stopping the box end from making a connection follow these procedures:

   a. Attach a drill bit and stabilizer to the pipe.

   b. Lower the pipe until contact is made with the material. Turn on the air and drill down until the bit slightly contacts the pipe. Keep the air circulating to clean away any material from around the box end.

   c. Pull up the pipe and take off the stabilizer and bit.

   d. Lower the pipe back down the hole to make a connection with the end of the dropped pipe.

   e. Once the connection has been made turn the air and rotation on and proceed to hoist the pipe to the surface.

3. **Pipe stuck in a drill hole**

   Follow these procedures to retrieve drill pipe that is stuck in a hole:

   a. First pour diesel fuel down the hole so that the fuel passes between the pipe and the walls of the hole. Give enough time for the fuel to work its way down the sides of the pipe.

   b. Attach the open pipe on the drill to the pipe that is stuck.

   c. Work the rotation control back and forth until the pipe starts to rotate.

   d. Once the pipe starts to rotate keep the pipe rotating until the pipe comes to the surface.

   e. While the pipe is rotating apply air pressure. If the air pressure builds up too high, shut off the air to the pipe.

   f. Keep the pipe rotating and hoist it up until the pipe starts to bind again. If it binds, lower the pipe slightly until the rotation picks up once more. Then start to hoist up again. Keep doing this until the material that is caught above the stabilizer and the bit is broken up.

   g. Once it is broken up the pipe should come up freely. Use air pressure to clear the hole as the pipe is hoisted.

   A jammed pipe can be pulled out with the hydraulic hoist. It is recommended that when pulling pipe out hydraulically, no rotation is used. This depends on the circumstances.

OBJECTIVE 8-2

The drill operator will demonstrate the proper procedures for sampling as set out by the company.

KEYPOINTS/PROCEDURES

1. Each mining company has specific sampling procedures that are established to suit the particular property. There is no consistent method of sampling. It is the responsibility of the individual company to supply the drill operator with the information as to how they want the samples to be taken.

Province of British Columbia

OPEN PIT MINING JOB
ROTARY DRILL
SKILL PROFILE

BASIC SAFETY AND OPERATING RULES	EXPLAIN THE IMPORTANCE OF SAFETY AND OPERATING RULES	EXPLAIN THE IMPORTANCE OF REPORTING ACCIDENTS AND INJURIES	EXPLAIN THE IMPORTANCE OF STAYING ALERT TO CHANGING CONDITIONS	EXPLAIN THE COMPANY TRAFFIC CONTROL SCHEME	EXPLAIN NORMAL AND EMERGENCY BRAKING TECHNIQUES	EXI EMER SHUT PROC
	EXPLAIN THE COMPANY'S POWER CABLE HANDLING PROCEDURES	EXPLAIN THE COMPANY'S LOCK-OUT PROCEDURES				
COMMUNICATIONS	SEND AND RECEIVE SIGNALS	FILL OUT REPORT FORMS	OPERATE THE MOBILE RADIO	READ SURVEY STAKES		
INDICATORS AND CONTROLS	LOCATE AND IDENTIFY THE GAUGES, INDICATORS, CONTROLS AND SWITCHES	DESCRIBE THE FUNCTION OF EACH CONTROL AND SWITCH	DESCRIBE THE GAUGES, INDICATORS AND WARNING SIGNALS AND EXPLAIN THE ACTION TO TAKE			
PRE-START AND OPERATIONAL CHECKS	LOCATE AND IDENTIFY THE BASIC UNITS AND RELATED COMPONENTS	LOCATE IN SEQUENCE THE PRE-START AND OPERATIONAL CHECK POINTS	PERFORM A PRE-START CHECK	PERFORM START UP AND SHUT DOWN PROCEDURES	PERFORM OPERATIONAL CHECKS	DESC THE PROCE A COLD ENGINE (OPTIONAL
BASIC OPERATION	PROPEL THE DRILL	STEER THE DRILL	LEVEL THE DRILL	RAISE THE MAST	OPERATE THE TOOL WRENCH	OPE CASING
	ADD PIPE FROM THE PIPE RACK	RACK THE PIPE	RETRACT THE LEVELLING JACKS	REMOVE THE DRILL BIT	REMOVE THE STABILIZER	RETRA MAST AN AND BAC
SERVICE THE DRILL	PRACTISE GOOD HOUSEKEEPING	LUBRICATION PROCEDURES				
MOVE THE DRILL	ASSIST THE FOREMAN TO PLAN A MOVE	CHECK THE ROAD CONDITIONS	PREPARE THE DRILL FOR A MOVE	PREPARE THE DRILL FOR TOWING	MOVE THE DRILL ON A RAMP	
SPECIAL ASSIGNMENTS	FISHING TECHNIQUES	COMPANY SAMPLING PROCEDURES				

JOB TRAINING SERIES
RILL OPERATOR
'OFILE CHART

Developed by:
Research and Curriculum Development Branch
P-st-Secondary Department
[illegible]istry of Education
[illegible]3

EXPLAIN EMERGENCY SHUT DOWN PROCEDURES	EXPLAIN THE IMPORTANCE OF GOOD HOUSEKEEPING	EXPLAIN THE COMPANY BLASTING AND GUARDING PROCEDURES	DESCRIBE THE BASIC LAYOUT OF THE PIT AREA	EXPLAIN THE USE OF FIRE EXTINGUISHERS AND FIRE SUPPRESSION SYSTEMS	DESCRIBE MISS-HOLES AND MISS-HOLE REPORTING PROCEDURES	EXPLAIN THE IMPORTANCE OF KEEPING PERSONNEL OFF OF THE DRILL DECKING DURING OPERATION
DESCRIBE THE PROCEDURES FOR A COLD WEATHER ENGINE START (OPTIONAL SECTION)						
OPERATE CASING TONGS	UNCOUPLE PIPE	RAISE THE ROTARY HEAD	ATTACH THE STABILIZER	ATTACH THE DRILL BIT	PREPARE TO DRILL AND COLLAR THE HOLE	DRILL THE HOLE
RETRACT THE MAST ANCHOR PINS AND BACK BRACES	LOWER THE MAST					

THE DACUM APPROACH

DACUM is a systematic model of program development used in designing career, technical and vocational training programs. The first step in the process is to establish the skills expected of a graduate entering employment. These skills are generally specified by a representative employer group in a workshop conducted by program development specialists. The product of this activity is a skill profile chart. This chart is then circulated both to the participants and to a number of other employers for review prior to further development.

The next step is to specify learner-centred performance objectives. These include not only the skills a learner must demonstrate but also the conditions under which the skill is to be performed and the criteria used to determine the acceptable standard of performance.

Once the performance objectives have been set, there are three important steps to complete the development process. These are generally undertaken by an instructor or group of instructors, in the following order:

1) Appropriate evaluation instruments are chosen or created to assess student capability in relation to the specific objectives of the program.

2) A variety of suitable instructional techniques and learning experiences are chosen to facilitate learning of the skills and knowledge required to meet the objectives.

3) Instructional resources (texts, films, models, and other learning aids) are selected or created.

READING THE SKILL PROFILE CHART

A skill profile chart (often referred to as a DACUM Chart), is a graphic representation of the essential skills expected of a student graduating from a specific career, vocational or technical program.

Broad areas of employee responsibility are shown in the boxes on the left of the chart. These are called "general areas of competence". The tasks or skills related to each are sequenced along the horizontal track to the right of the general area of competence.

FOR FURTHER INFORMATION

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